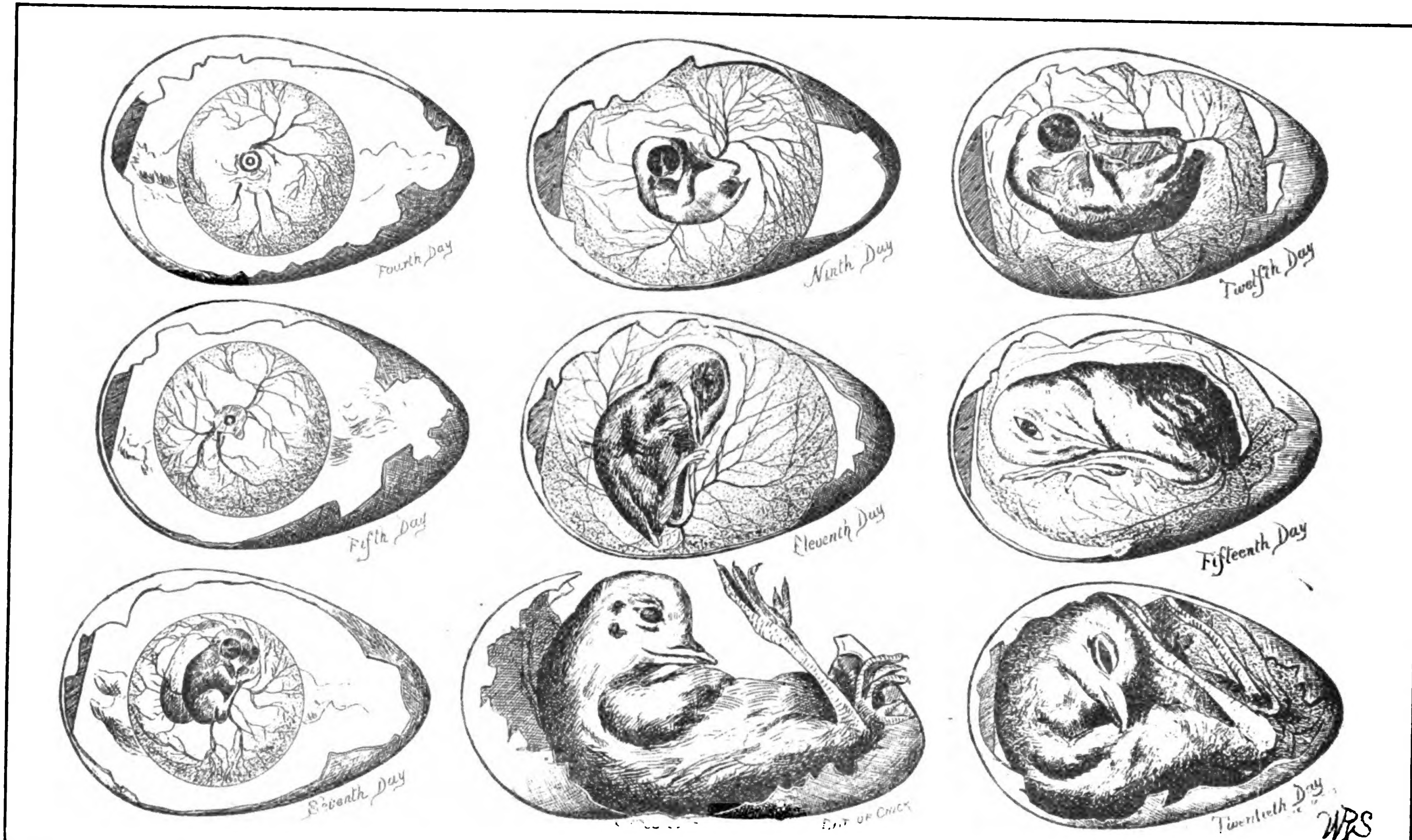

PROGRESS OF INCUBATION. (FROM COUNTRY GENTLEMAN.)

THE COMMONWEALTH OF PENNSYLVANIA.

AGRICULTURE OF PENNSYLVANIA,

CONTAINING

REPORTS

OF THE

STATE BOARD OF AGRICULTURE

THE

STATE AGRICULTURAL SOCIETY, THE STATE DAIRYMEN'S ASSOCIATION, THE STATE HORTICULTURAL ASSOCIATION, AND THE STATE COLLEGE.

FOR 1887.

HARRISBURG:
EDWIN K. MEYERS, STATE PRINTER.
1888.


VIRTUE LIBERTY AND INDEPENDENCE

ELEVENTH ANNUAL REPORT

OF THE

PENNSYLVANIA STATE BOARD OF AGRICULTURE

FOR THE YEAR 1887.

Members Ex-Officio.

Hon. James A. Beaver, *Governor.*
Hon. T. J. Stewart, *Secretary of Internal Affairs.*
Dr. E. E. Higbee, *Superintendent of Public Instruction.*
Hon. A. Wilson Norris, *Auditor General.*
Dr. G. W. Atherton, *President of the Pennsylvania State College.*

Appointed by the Governor.

	Term expires.
Col. James Young, Middletown, Pa.,	1888
Dr. John P. Edge, Downingtown, Pa.,	1889
Will B. Powell, Springboro', Pa.,	1890

Elected by County Agricultural Societies.

			Term expires.
Adams,	I. Garretson,	Bigler,	1888
Armstrong,	Jos. Painter,	Kittanning,	1890
Beaver,	A. L. McKibben,	Green Garden,	1890
Bedford,	J. E. Noble,	Waterside,	1890
Berks,	J. G. Zerr,	Geiger's Mill,	1889
Bucks,	E. Reeder,	New Hope,	1890
Blair,	J. D. Hicks,	Altoona,	1889
Bradford,	H. L. Scott,	Towanda,	1889
Butler,	H. M. Wise,	Harmony,	1888
Centre,	E. W. Hale,	Bellefonte,	1888
Chester,	Thomas J. Edge,	Harrisburg,	1890
Clarion,	J. F. Brown,	Clarion,	1888
Clinton,	J. A. Herr,	Cedar Springs,	1890
Columbia,	Chandlee Eves,	Millville,	1888
Crawford,	M. W. Oliver,	Conneautville,	1889
Cumberland,	C. H. Mullin,	Mt. Holly Springs,	1888
Dauphin,	G. Hiester,	Harrisburg,	1888
Delaware,	E. Harvey,	Chester,	1889
Erie,	J. C. Thornton,	Avonia,	1889
Indiana,	W. P. Gordon,	Black Lick,	1889
Jefferson,	J. McCracken, Jr.,	Frostburg,	1890
Juniata,	D. Wilson,	Port Royal,	1888
Lackawanna,	H. H. Colvin,	Dalton,	1888
Lancaster,	H. M. Engle,	Marietta,	1889
Lebanon,	C. R. Lantz,	Lebanon,	1888
Lehigh,	J. P. Barnes,	Allentown,	1890
Luzerne,	J. B. Smith,	Kingston,	1888
Lycoming,	D. H. Foresman,*	Williamsport,	1888
Lycoming,	P. Reeder,†	Hughesville,	1889
Mercer,	R. McKee,	Mercer,	1890
Montgomery,	H. W. Kratz,	Trappe,	1890
Montour,	Thos. L. Clapp,	Limestoneville,	1889
Northampton,	A. D. Shimer,	Bethlehem,	1888
Northumberland,	John Hoffa,	Milton,	1890
Somerset,	C. C. Musselmann,‡	Somerset,	1889
Schuylkill,	J. S. Keller,§	Orwigsburg,	1890
Sullivan,	L. B. Speaker,	Hill's Grove,	1888
Susquehanna,	R. S. Searle,	Montrose,	1889
Tioga,	J. W. Mather,	Wellsboro',	1889
Union,	J. A. Gundy,	Lewisburg,	1890
Venango,	Wm. Gates,	Oil City,	1889
Warren,	F. R. Miller,	Sugar Grove,	1889
Washington,	J. McDowell,	Washington,	1890
Wayne,	N. F. Underwood,	Lake Como,	1889
Westmoreland,	F. Y. Clopper,	Greensburg,	1889
Wyoming,	N. G. Bunnell,	Vosburg,	1888
York,	W. S. Roland,	York,	1889

* Died April 21, 1887.
† Elected October 12, 1887.
‡ Died August 21, 1887.
§ Died February 22, 1887.

OFFICIAL LIST.

President.

Hon. James A. Beaver, (*ex-officio.*)

Vice Presidents.

M. W. Oliver, Dr. J. P. Edge, N. F. Underwood.

Executive Committee.

Hon. James A. Beaver, C. C. Musselman, E. Reeder, W. S. Roland, G. Hiester, J. McDowell, J. P. Barnes, J. A. Herr, T. J. Edge, (*ex-officio.*)

Advisory Committee.

W. S. Roland, J. P. Barnes, Thos. J. Edge, (*ex-officio.*) G. Hiester.

Secretary.

Thos. J. Edge, Harrisburg.

Botanist.

Thos. Meehan, Germantown.

Pomologist.

E. Satterthwaite, Jenkintown.

Chemist.

Prof. F. A. Genth, University of Pennsylvania.

Consulting Veterinary Surgeon.

Prof. R. S. Huidekoper, University of Pennsylvania.

Veterinary Surgeon.

Dr. F. Bridge, V. S., West Philadelphia.

Microscopists and Hygienists.

Dr. H. Leffmann, Philadelphia, Prof. C. B. Cochran, West Chester.

Entomologist.

Prof. W. A. Buckhout, State College.

Ornithologist.

Dr. B. H. Warren, West Chester.

Meteorologists.

Prof. I. T. Osmond, State College, J. L. Heacock, Quakertown.

Mineralogist.

Prof. J. Wilcox, Philadelphia.

Geologist.

Prof. J. P. Lesley, Philadelphia.

Stenographer.

Col. H. C. Demming, Harrisburg.

STANDING COMMITTEES—1887.

EXECUTIVE COMMITTEE.

Hon. J. A. Beaver,	W. S. Roland,	J. P. Barnes,
C. C. Musselman,	G. Hiester,	J. A. Herr,
E. Reeder,	J. McDowell,	T. J. Edge, (*ex-officio.*)

ADVISORY COMMITTEE.

W. S. Roland,	J. P. Barnes,	G. Hiester.
	T. J. Edge, (*ex-officio.*)	

LEGISLATION.

Dr. J. P. Edge,	W. S. Roland,	N. F. Underwood,
J. McDowell,	William Gates,	C. C. Musselman,
J. A. Gundy,	J. W. Hicks,	T. J. Edge, (*ex-officio.*)

FRUIT AND FRUIT CULTURE.

G. Heister,	D. Wilson,	C. C. Musselman,
H. M. Engle,	W. S. Roland,	N. F. Underwood,
M. W. Oliver,	T. L. Clapp,	J. A. Herr,
H. W. Kratz,	H. H. Colvin,	J. Calder.

FORESTS AND FORESTRY.

W. Gates,	I. Garretson,	J. Painter,
J. E. Noble,	J. A. Herr,	Dr. J. P. Edge,
H. M. Engle,	J. McCracken, Jr.,	C. R. Lantz,
J. Young,	T. Meehan,	H. L. Scott.

APIARY.

M. W. Oliver,	H. H. Brown,	J. Shallcross,
I. Garretson,	G. Prizer,	Mrs. M. L. Thomas,
Arthur Todd,	E. Harvey,	A. L. McKibben.

SILK AND SILK CULTURE.

J. P. Barnes,	R. S. Searle,	G. W. Atherton,
W. Gates,	Dr. J. P. Edge,	J. G. Zerr,
G. Hiester,	D. H. Foresman,	H. H. Colvin.

WOOL AND TEXTILE FIBRES.

J. McDowell,	R. S. Searle,	Chandlee Eves,
Will B. Powell,	Asbury Struble,	Edward Walter,
J. A. Herr,	J. Young,	J. C. Thornton.

ROADS AND ROAD LAWS.

D. Wilson,	T. L. Clapp,	George W. Hood,
H. H. Colvin,	J. Hoffa,	J. D. Hicks,
Chandlee Eves,	H. W. Kratz,	F. R. Miller.

FARM IMPLEMENTS AND MACHINERY.

I. Garretson,	G. Hiester,	M. W. Oliver,
J. A. Herr,	E. Reeder,	C. C. Musselman.
N. F. Underwood,	W. Gates,	

CEREAL CROPS.

J. A. Herr,	R. McKee,	F. R. Miller,
J. McDowell,	T. L. Clapp,	H. M. Wise,
J. C. Thornton,	F. Y. Clopper,	J. G. Zerr,
R. S. Searle,	A. D. Shimer,	Chandlee Eves,
C. R. Lantz,	H. M. Engle,	C. C. Musselman.

GRASSES AND FODDER CROPS.

N. F. Underwood,	W. R. Shelmire,	J. A. Herr,
J. McDowell,	F. R. Miller,	J. G. Zerr.
J. C. Thornton,	N. G. Bunnell,	

DAIRY AND DAIRY PRODUCTS.

E. Reeder,	C. C. Musselman,	Chandlee Eves,
H. L. Scott,	I. Garretson,	R. S. Searle,
M. W. Oliver,	J. G. Zerr,	C. B. Cochran.

USEFUL BIRDS.

C. C. Musselman,	N. G. Bunnell,	E. Reeder,
B. H. Warren,	H. L. Scott,	Dr. J. P. Edge,
G. Heister,	J. E. Noble,	J. B. Smith.

POULTRY.

H. M. Engle,	G. Hiester,	W. C. Gordon,
J. E. Noble,	T. L. Clapp,	J. A. Gundy.
I. Garretson,	F. R. Miller,	

ORNITHOLOGY.

B. H. Warren, M. D.,	Joseph H. Jackson,	Will B. Powell,
E. Reeder,	C. C. Musselman,	G. B. Sennett,
C. W. Roberts,	C. J. Pennock,	G. W. Atherton.

EXTRACT FROM AN ACT

To regulate the publication, binding and distribution of the public documents, approved April 16, 1887,

"Thirty-one thousand five hundred and ten copies of the work entitled the 'Agriculture of Pennsylvania,' in style, manner, and form prescribed by law; eight thousand for the Senate, twenty thousand for the House of Representatives, one thousand five hundred for the Board of Agriculture, five hundred for the State Agricultural Society, five hundred for the Dairymen's Association, three hundred for the Fruit Growers', fifty for the State College, one hundred for the Governor, to be distributed by him, sixty for the Librarian for distribution and exchange with the States and Territories, and five hundred for reserve work."

EXTRACT FROM AN ACT

To authorize the printing and binding of the reports of the State Board of Agriculture, and other State agricultural reports.

SECTION 2. The matter for said volume shall be proportioned to the several organizations as follows: To the State Board of Agriculture, two hundred and fifty pages; to the State Agricultural Society, two hundred pages; to the State Dairymen's Association, one hundred pages; to the State Fruit Growers' Association, eighty pages, and to the State College, twenty pages, the whole volume not to contain more than six hundred and fifty pages: *Provided*, That each organization shall compile and arrange its own matter, and that no matter shall be used by either which is not original and legitimate to the organization offering the same.

SECTION 3. For the compilation, arranging and indexing of said matter, the sum of seven hundred and thirty dollars is hereby annually appropriated, to be paid out of any money in the treasury not otherwise appropriated, upon the receipt of the Superintendent of Public Printing and Binding, that all of the matter has been delivered to him; said sums to be divided as follows: To the State Agricultural Society, two hundred and fifty dollars; to the State Dairymen's Association, three hundred and fifty dollars, and to the State Fruit Growers' Association, one hundred and thirty dollars; and that each organization shall deliver the whole of its report in manuscript to the Superintendent of Public Printing and Binding on or before the first day of November of each year.

OBITUARY.

JOSHUA S. KELLER.

BORN AUGUST 7, 1816.

DIED FEBRUARY 22, 1887.

Joshua S. Keller, late member of the State Board of Agriculture from Schuylkill county, was elected to represent his society at the organization of the Board in 1877, and continued to serve in this capacity to the time of his death, having (January 29, 1887) been recently reëlected for the term of three years.

Mr. Keller was born in Greenwich township, Berks county, Pa., August 7, 1816. He received his primary education in the schools which characterized that date, and afterwards completed it at the Maiden Creek school, at Franklin and Marshall College, and at Mercersburg, Pa. For a number of years he taught school in the counties of Berks, Centre and Schuylkill. During a portion of his life he was engaged in mercantile pursuits at Hamburg, Berks county, Pa. After his marriage, he engaged in agriculture and horticulture at Orwigsburg, and there continued until the time of his death.

In addition to his membership in the State Board of Agriculture, Mr. Keller was a prominent member and officer of the State Agricultural Society, and also an active member of the State Horticultural Association. He was one of the founders of the Schuylkill County Agricultural Society, and after its organization served for a number of years as its secretary. He relinquished the work of the secretary's office to assume that of president, which he continued to exercise to the time of his death.

In his own locality, Mr. Keller was depended upon for advice upon matters pertaining to agriculture and horticulture, and was a prominent correspondent of various agricultural and horticultural journals. His essays were invariably practical, and were received with perfect confidence by the reader. He was the originator of the "Keller's Seedling Strawberry," and during the latter part of his life was a careful experimenter with new fruits, honestly giving the results of his experiments for the benefit of others.

OBITUARY.

DAVID HAMMOND FORESMAN.

BORN FEBRUARY 15, 1834.

DIED APRIL 21, 1887.

David Hammond Foresman, late member of the Board from Lycoming county, was born in Washington township, Lycoming county, Pa., February 15, 1834, and died at his home in Williamsport, April 21, 1887.

His early life was spent on the farm, and he there imbibed that love for and interest in agricultural affairs which clung to him throughout his life and which made him so valuable as a member of the Board of Agriculture; he received the principal part of his education at the McEwensville Academy, and for several years taught school in the counties of Northumberland and Lycoming; in 1854 he settled in Williamsport and soon became deeply interested in the welfare of that city; he was for fourteen years a member of the common council, and in 1877 was chosen its president; he also filled the difficult position of chairman of the highway committee with signal ability.

He was twice elected president of the Lycoming County Agricultural Society, and was identified with the grange movement having served several terms as master of the Williamsport Grange.

He was elected by the Lycoming County Agricultural Society to represent them in the formation of the State Board of Agriculture in 1877, and continued their representative until the day of his death, having been elected for four consecutive terms.

Mr. Foresman was a man of superior intelligence and of marked energy and executive ability; with the valuable faculty of self-control, he ruled with wisdom and fairness; like all strong men, he possessed a strong emotional nature, and was capable of being influenced through his emotions; in his friendships he was remarkably constant and devoted; in the domestic circle he was at his happiest and appeared to the best advantage, and his affection for his family was one of his most conspicuous traits.

As a member of the Board, his counsel was always received with the respect and appreciation which it deserved, and his opinions were advanced with force and strength, begotten of a feeling that they were correct and right; as one of the vice presidents of the Board, his rulings were always fair and just, and his firmness tempered with justice.

OBITUARY.

CHRISTIAN C. MUSSELMAN.

Born December 23, 1826.
Died August 21, 1887.

Christian C. Musselman, late member of the Board from Somerset county, was born in Summit (now Elk Lick) township, Somerset county, Pa., December 23, 1826, and died at his home in Somerset, August 21, 1887.

At the age of fourteen years he was apprenticed to the trade of a shoemaker; the occupation being distasteful to him, and being a persevering student, he, at the age of seventeen, commenced teaching and alternating this with farm labor, as was the custom of the time, he soon arrived at the head of his chosen profession. He acted as the president of the first teachers' institute held in the county of Somerset, and from time to time took a prominent part in every movement, having for its object the advancement of his chosen profession.

Having a strong taste for practical and experimental farming, he abandoned the school-room and purchased a farm near the town of Somerset, upon which he lived until within two years of his death; this farm was his pride, and is now a model for others in the neighborhood, and many of his practical works in our Board were the result of information gained while on the farm.

At different times during his useful and active life, Mr. Musselman was called upon to occupy responsible positions of public trust, and and in every case the trust was returned to his constituents untarnished with anything detrimental to his or their credit. From time to time he filled all of the local and township offices within the gift of his constituents, and in 1849 acted as moderator in the famous debate at Mechanicsburg (now Summit Mills), between the representatives of the German Baptists and the Lutherans. In 1863 he was elected a member of the lower house of the State Legislature; at the next term he was renominated and elected by an even larger majority; his record as a member of the State Legislature is unimpeached, and but for his refusal to serve, he would no doubt have been selected to fill still higher positions in the Legislature of his State.

In 1877 he was elected associate judge of Somerset county; in 1878 he became one of the directors of the Somerset and Cambria railroad, and when that road was purchased by the Baltimore and Ohio he was the only member of the old board reëlected.

In 1878 he was elected by the Somerset County Agricultural Society to represent them in the State Board of Agriculture, and continued their representative until his death. As a member of the Board he was noted for the earnestness with which he advocated his views upon practical agricultural topics, and for his practical essays and addresses at its meetings. Earnest as he was, he was careful not to unduely cause unpleasantness to his colleagues, and was universally respected by them for his earnest advocacy of all that he believed to be right and just, and for his unwavering opposition to anything resembling fraud or imposition.

By his death our Board loses an earnest and practical member whose position it will be difficult to fill.

PROCEEDINGS

OF THE

PENNSYLVANIA STATE BOARD OF AGRICULTURE.

MINUTES OF THE ANNUAL MEETING.

Held at Harrisburg, commencing January 26, 1887.

Board called to order at 9.30 A. M., by Vice President M. W. OLIVER in the chair.

Present, Hon. J. S. Africa, Dr. E. E. Higbee, Messrs. Atherton, Young, Dr. Edge, Garretson, Noble, Zerr, Scott, Brown, Eves, Oliver, Mullin, Hiester, Thornton, Wilson, Colvin, Engle, Lantz, Smith, Clapp, Musselman, Searle, Gates, Bunnell, Underwood, Roland and Secretary.

The SECRETARY announced that the terms of office of one-third of the members of the Board expired previous to this meeting, and that from this cause their names were not called; nearly all of them had been reëlected and were present, and after the presentation of their credentials, would take part in the work of the meeting.

The CHAIR named Messrs. Barnes, Gates and Musselman a committee to receive and report upon the credentials of members-elect and delegates.

On motion, a recess was taken until the Committee on Credentials were ready to report.

Committee on Credentials reported that Messrs. Painter of Armstrong, Reeder of Bucks, Edge (T. J.) of Chester, McCracken of Jefferson, Barnes of Lehigh, McKee of Mercer, Hoffa of Northumberland, Gundy of Union, McDowell of Washington, Kratz of Montgomery, presented credentials showing that they had been properly appointed by their respective county agricultural societies to represent them in the Board.

The committee also reported that a certificate for Mr. Keller of Schuylkill was not in proper form, and, after discussion, the Secretary was directed to return it and furnish a proper blank.

The committee further reported the following delegates as present with proper certificates:

East Lynn Grange, P. of H., No. 271—Pennock E. Leonard, C. F. Wickersham.

Grange No. 353, (Huntingdon county.)—Miles Henderson.

Middletown Grange No. 684—Allen Tomlinson, John Wildman.

Fulton Grange No. 66—J. G. McSparren.

Clarion County Pomona Grange—Henry Cyphert.

Brandywine Grange No. 60—S. R. Downing.

Goshen Grange No. 121—Dr. B. H. Warren.

Huntingdon County Pomona Grange—A. P. White.

State Horticultural Association—John C. Hepler, H. S. Rupp, H. C. Snavely and Col. George F. McFarland.

Berks County Agricultural Society—George D. Stitzel, Tobias Barto, Joseph F. Moore.

Pennsylvania Forestry Association—C. C. Binney and Hon. J. Hess.

Lancaster County Agricultural and Horticultural Society—Calvin Cooper, John H. Landis, Johnson Miller, W. H. Brosius.

Farmers' Protective Association of Philadelphia—E. Satterthwaite, S. N. Roland, I. P. Thomas and Jesse Wilson.

Chester County Agricultural Society—Alfred Sharpless, B. H. Warren, M. D.

Columbia County Agricultural Society—H. V. White.

Solebury Farmers' Club—Asher Mattison, H. W. Rice, W. M. Ely.

On motion, the Board then proceeded to the election of officers for the coming year, and as tellers the CHAIR named Messrs. Scott, Gundy and Zerr

Messrs. Reeder, Underwood, Herr, Oliver, Dr. Edge and Searle were then nominated for the positions of vice presidents. The tellers announced that Messrs. Oliver, Edge and Underwood had been elected by the first ballot.

Messrs. Reeder, Musselman, Herr, Hiester, Roland, McDowell, Gates, Wilson, Barnes and Searle were then nominated as members of the Executive Committee. On motion, Messrs. McDowell, Searle and Gates were allowed to withdraw their names.

The tellers announced as the result of the first ballot the election of Messrs. Musselman, Roland, Reeder, Hiester, McDowell, Barnes and Herr.

On motion of Mr. ROLAND, seconded by Mr. SMITH, the CHAIR named Messrs. Roland, Mullin and McDowell a committee to wait upon the Governor and escort him to the meeting.

On motion of Mr. NOBLE, Thomas J. Edge was nominated Secretary, and on motion of Mr. Reeder, the President was directed to cast the ballot of the meeting for him.

On motion of Mr. GATES, the reading of the minutes was dispensed with.

The Committee on Legislation reported as follows:

Your Committee on Legislation would, in accordance with the rules of the Board, respectfully report upon the following topics, which have engaged their attention:

First. They have taken into consideration the interests of the Board and its work, and find that its field of operations has so widened and enlarged that some legislation is required to provide the means to carry on its work. We, therefore, recommend that the act for granting the usual appropriation be so amended as to provide that the item for district institutes, &c., be increased in the sum of two thousand dollars, making a total of three thousand dollars, to meet the demand of the different counties for the benefit of institute meetings. We also recommend the passage of a supplement to the act providing for the publication of the annual volume on "The Agriculture of Pennsylvania," so that more space shall be assigned to the production of this Board, the present allotment being much too limited to contain a fair digest of its transactions. We also suggest the propriety of asking the General Assembly to authorize the Board to enlarge the

space allotted to its quarterly reports, and also an increase in the number issued, or else the issuing of a special volume to be made up from the essays and discussions that have not heretofore been published.

We have also considered the act of the last session of the Legislature, known as the "Scalp or bounty act," and we are unanimous in favor of its repeal. The act is an illustration of the evils of unadvised legislation, and has, in the brief period of its operation, been sadly injurious to the general interests of the farmer and fruit-grower, as well as expensive to the several counties. The approval of the Board is asked for the herewith attached act, which is intended to accomplish this purpose.

Your committee also took favorable action upon the accompanying bill offered by Mr. Gates of Venango, and recommend its indorsement by the Board. The effect of its passage by the General Assembly would be to repeal the fence law of 1700.

Mr. McDowell of Washington introduced the question of the legalizing of the passage of traction engines along our public roads, (see act of previous session of the Legislature,) and advocated the theory that the several townships and municipalities of the State should be protected from liability from action for damages in cases where bridges and culverts are broken down by the great weight of said engines. The subject was referred to a sub-committee consisting of Messrs. McDowell, Oliver and Gates.

On behalf of the committee.

JOHN P. EDGE,
Chairman.

On motion of the Secretary, that portion of the report of the Committee on Legislation referring to the repeal of the "scalp act," was withheld from discussion until the evening session, when it would be in proper order.

The report of the Legislative Committee, as it referred to fences, was discussed by Messrs. Searle, Edge, Oliver, Gates, Wilson, Scott, McKee, Noble, Musselman, Smith, Gundy, Eves and the Secretary, and the repeal of the second section of the act of June 23, 1885, (to repeal the first section of an act entitled "An act for the regulation and maintaining fences," passed Anno Domini, one thousand seven hundred,) the effect of which repeal would be that of removing the whole of the act of 1700 from the statute book without a vote by counties.

His Excellency, Governor James A. Beaver, was here introduced, and, on motion, a recess of ten minutes was taken.

Board re-assembled, Hon. James A. Beaver in the chair, who then addressed the Board, promising them his hearty coöperation and assistance during his term of office, and regretting his inability to preside at all of the sessions on account of the great pressure of official duty incident to the commencement of a new term of office.

On motion of the Secretary, the morning session was extended to one o'clock, so that the printed programme might be carried out.

On behalf of the Committee on Farm Implements and Machinery, Mr. GARRETSON of Adams, chairman, read the report of the committee, which, after discussion, was ordered to be incorporated in the proceedings of the Board.

On behalf of the Committee on Useful Birds, C. C. MUSSELMAN of

Somerset, chairman, presented the extended and instructive report of that committee, upon which discussion was postponed until the evening session, and the report ordered to form a portion of the proceedings of the Board.

On behalf of the Committee on Fences and Fencing, CHANDLEE EVES of Columbia, chairman, stated that their report was incorporated with that of the Committee on Legislation, so far as the same referred to their special topic.

His Excellency Governor BEAVER announced that he had appointed Will B. Powell of Crawford, as a member of the Board, to fill the existing vacancy in the list of his appointés.

On motion, the appointment of the chairmen of the standing committees of 1887 was referred to the Executive Committee. At a subsequent session this committee reported these chairmanships, as follows:

Legislation, Dr. J. P. Edge; Fruit and Fruit Culture, G. Hiester; Grasses and Forage Crops, N. F. Underwood; Forests and Forestry, Wm. Gates; Apiary and Bee Culture, M. W. Oliver; Dairy and Dairy Products, E. Reeder; Useful Birds, C. C. Musselman; Cereal Crops, J. A. Herr; Roads and Road Laws, D. Wilson; Wool and Textile Fibers, J. McDowell; Farm Implements and Machinery, I. Garretson. They also reported in favor of establishing a standing committee on poultry, with H. M. Engle as chairman.

The same committee also reported the following Advisory Committee and honorary officers:

Advisory Committee—G. Hiester, W. S. Roland and J. P. Barnes. *Botanist*, Thomas Meehan, Germantown; *Pomologist*, E Satterthwait, Jenkintown; *Chemist*, Dr. F. Genth, University of Pennsylvania; *Consulting Veterinary Surgeon*, Prof. R. S. Huidekoper, University of Pennsylvania; *Veterinary Surgeon*, Dr. F. Bridge, V. S., West Philadelphia; *Entomologist*, Prof. W. A. Buckhout, State College; *Microscopists and Hygienists*, Dr. H. Leffmann, Philadelphia, and Prof. C. B. Cochran, West Chester; *Ornithologist*, Dr. B. H. Warren, West Chester; *Meteorologists*, Prof. I. P. Osmond, State College, and J. L. Heacock, Quakertown; *Mineralogist*, Prof. J. Wilcox, Philadelphia; *Geologist*, Prof. J. P. Lesley, Philadelphia; *Stenographer*, Col. H. C. Demming, Harrisburg.

On motion, the Board then proceeded to decide as to the place of the next meeting, when Mr. Reeder named Bellefonte, and after discussion, it was decided to hold the spring meeting at Bellefonte, at a time to be fixed by the resident member and the Advisory Committee.

New business being in order, Rev. W. L. Bull explained the provisions of an act relating to "Wayfarers' Lodges," which he proposed to introduce into the Legislature, and upon which he wished the indorsement or opinion of the Board; after discussion, the matter was referred to a special committee, consisting of Messrs. Wilson, McKee and Reeder, who, at a subsequent session, submitted the following report, which, on motion, was adopted by the Board:

"Your committee, having examined the draft of a bill presented by the Rev. Mr. Bull and others, entitled 'An act to provide for the temporary care and employment of wayfarers,' and fully realizing the serious effect of the tramp evil upon the well-being of the community at large, recommend the following resolution:

"*Resolved*, That the members of the Legislature be earnestly re-

quested to consider the advisability of framing a new tramp act, which shall embody the principle laid down in the draft of the 'wayfarers' lodge bill,' which is that no assistance should be granted the vagrant or tramp without something in the shape of work being exacted in return therefor, which shall accrue to the benefit of the public."

(Signed) DAVID WILSON,
ROBT. MCKEE,
E. REEDER.

On motion, adjourned until 2 P. M.

WEDNESDAY AFTERNOON, *January 26, 1887.*

Board called to order at 2 P. M., by Dr. J. P. EDGE, Vice President, in the chair.

M. W. OLIVER read an essay in answer to the question, "Does Farming Pay in Pennsylvania?" The subject matter of which was discussed by Messrs. Dr. Edge, Wilson, Gundy, Oliver, Witmer, Searle, Smith, Barnes, Brosius and Secretary.

E. SATTERTHWAITE read an essay on "The Timber Question, and what Trees to Plant," which was discussed by Messrs. Hess, Searle, Dr. Edge, Roland, Oliver and Binney.

Messrs. HESS and BINNEY announced that they were present as delegates from the Pennsylvania Forestry Association, for the purpose of explaining two drafts of acts which they proposed to submit to the Legislature, and upon which they wished to obtain the advice and opinion of the Board. After discussion, the delegation were referred to the Committee on Legislation, who were directed to make a report at a subsequent session.

An essay entitled "Retrospective," prepared by the Secretary, was then read by Mr. HIESTER, and discussed by Messrs. Underwood, Dr. Edge and Smith.

On motion of Mr. BARNES, a committee of three, consisting of Messrs. Hoffa, Clapp and Herr, were appointed to draft and present for consideration resolutions expressive of the sense of the Board in relation to the death of W. C. Packer, late member from Northumberland.

After answering sundry questions which had been sent to the Secretary, the Board adjourned to meet at 7.30 P. M.

WEDNESDAY EVENING, *January 26, 1887.*

Board called to order at 7.30 P. M., to hear an address by Dr. B. H. WARREN, Ornithologist of the Board, on the "Food of Hawks and Owls."

After the close of the address, the Secretary presented a large amount of data, showing, among other things, the amount of bounty paid by each county of the State, and the opinion of each board of county commissioners in relation to the total or partial repeal of the act of June 23, 1885, "for the destruction of wolves, wild-cats, foxes, minks, hawks, weasels and owls in this Commonwealth."

Mr. NOBLE of Bedford read the resolution of Bedford County Pomona Grange against the repeal of the law. Colonel H. C. DEMMING, at the request of the Secretary, read letters from Daniel Steck and George Snyder, the former against the repeal of the law, and the latter in favor of repeal. C. F. WICKERSHAM, delegate from Chester county, read a short essay against the repeal of the act, and the sub-

ject was declared open for general discussion. The Secretary announced that it had been proposed to vote (at the close of the discussion) on the subject of repeal, as follows:

First. A vote as to its repeal, so far as it applies to hawks and owls, by the Board only; then by the audience.

Second. A vote as to the repeal of the whole law, by the Board, and then a similar vote by the audience.

Dr. J. P. EDGE offered the following:

Resolved, That for the protection of useful birds and animals remaining in the State from wholesale destruction suffered under the operation of what is known as "the scalp law," and also for the protection and relief of the county treasuries, the General Assembly be requested to favorably consider the act presented by the Committee on Legislation of this Board.

After discussion by Messrs. Searle, White, Musselman, Wilson, Colvin, Rice, Dr. Edge, Smith, Henderson, Engle, Gundy, Herr, Isenberg, Warren and Secretary, Dr. Edge and Mr. Gates were appointed a committee to draft a bill expressive of the wish of the Board, as indicated by the subsequent vote, and present the same to the Legislature for its action.

After a standing vote had been taken upon each phase of the question, the Secretary announced the result as follows:

Vote of the Board on the repeal of that portion of the act referring to hawks and owls—For repeal, 21; against repeal, 1.

Vote of the Board as to the repeal of the whole act—In favor, 18; against, 1.

Vote of the audience as to the repeal of that portion relating to hawks and owls—In favor, 37; against, 2.

Vote of the audience in relation to the repeal of the whole act—In favor, 25; against, 1.

On motion, adjourned until 9 A. M., Thursday morning.

THURSDAY MORNING, *January 27, 1887.*

Board called to order at 9 A. M., by M. W. OLIVER, Vice President, in the chair.

Mr. NOBLE read a series of resolutions from the Bedford County Pomona Grange, and from Bridgeport Grange No. 602, which were referred to the Committee on Legislation.

The SECRETARY presented the preamble and resolutions of Freehold Grange, (Warren county,) in favor of the repeal of the "Scalp law," which were referred to the Committee on Legislation.

On motion of Mr. ENGLE, it was decided to appoint a standing committee on ornithology, with Dr. B. H. Warren as chairman, with power to make up the committee.

Report of the special committee on the bill establishing wayfarers' lodges was presented, and discussed by Messrs. Searle, Oliver, Dr. Edge, Gundy, Whitmer, Garretson, McDowell, Musselman, Scott, Bull, Wilson, Noble, Young, Smith and Hiester, and adopted.

The special committee to whom was referred the question of damages done to public bridges and culverts by traction engines, made a report in the form of a draft of a bill for an additional section to the act of 1885, and Mr. McDowell was appointed to present the same to the Legislature.

On motion of Mr. REEDER, the regular order of business was taken up, and Mr. SEARLE read an essay on "Irrigation."

On motion of the SECRETARY, Dr. CALDER then read an essay on "Fruit Culture."

Mr. HIESTER then read an essay by H. M. Wise, (who was unavoidably absent,) on "Wheat Raising;" the subject-matter of which was discussed by Messrs. Powell, Whitmer, Roland, Searle, Engle, Hoffa, Young, Wilson, Scott, Oliver, Herr, Colvin, Zerr and White.

His Excellency Governor BEAVER presented an invitation from the New York Dairymen's Association to appoint delegates to represent Pennsylvania at the approaching annual meeting of that association, and requested the Board to suggest the names of such delegates. On motion of Dr. EDGE, the President and Secretary were requested to furnish names of suitable delegates.

Mr. BARNES of Lehigh, offered the following, which, after discussion, was referred to the Committee on Legislation:

"WHEREAS, The Governor of this Commonwealth frequently is required to appoint delegates or representatives to attend State and United States organizations for the general welfare of our State or the United States; therefore

"*Resolved*, That the Committee on Legislation be hereby requested to draw up an act to be presented to the honorable bodies of the Legislature, which shall authorize and empower the Treasurer of the Commonwealth to pay out of the general fund in his hands, all the necessary expenses incurred by such appointees, for such actual service rendered."

On motion, adjourned until 2 P. M.

THURSDAY AFTERNOON, *January 27, 1887.*

Board called to order at 2 P. M., by M. W. OLIVER, Vice President, in the chair.

Prof. R. S. HUIDEKOPER, consulting Veterinary Surgeon of the Board, delivered an address upon "Veterinary Education."

The committee to report resolutions relative to the death of W. C. Packer, late member from Northumberland, reported a series of resolutions, which were unanimously adopted.

JOHN I. CARTER read an essay on "The Feeding and Care of Dairy Cows," which was discussed by Messrs. Young, Huidekoper, Carter, Wilson and Secretary.

J. C. THORNTON then read an essay on "The General Purpose Cow," which was discussed by Messrs. Engle, Searle, Huidekoper, Thornton, Carter, Powell and Secretary.

Mr. REEDER offered the following resolution:

"*Resolved*, That this Board recommend to the Legislature that an appropriation to be devoted to the testing of samples of oleomargarine, suspected and imitation, and other butters, be granted for the use of the Board, and that the amount asked for be one thousand dollars per year for two years."

After discussion, the resolution was agreed to, and Messrs. Satterthwait and Reeder appointed a special committee to present the resolution to the House Committee on Appropriations, before whom the appropriation bill of the Board was pending.

Mr. SEARLE offered the following, which was unanimously adopted:

Resolved, That this Board request the Legislature not to repeal the act known as the "Oleomargarine Law;" adopted unanimously.

On motion, adjourned to meet at 7.30 P. M.

THURSDAY EVENING, *January 27, 1887.*

Called to order at 7.30 P. M., by M. W. OLIVER, Vice President, in the chair.

Hon. JOHN W. HICKMAN addressed the Board upon the subject of "How to Bring up a Worn-out Farm by the Use of Commercial Fertilizers Alone," and the remainder of the session was devoted to a complete and thorough discussion of the fertilizer question in all of its bearings.

Adjourned to meet at Bellefonte, at the call of the Advisory Committee.

MINUTES OF THE SPRING MEETING.

Held at Bellefonte and State College, June 8th and 9th, 1887.

Board called to order at 9.30 A. M. by Dr. John P. Edge, Vice President, in the chair.

On behalf of the Centre County Agricultural Society and the citizens of Bellefonte, Hon. A. O. Furst, president judge of the Twenty-fifth judicial district, addressed the Board as follows:

Mr. President and Members of the State Board of Agriculture of Pennsylvania: The pleasant duty has been assigned me to bid you a welcome to the county of Centre and to the borough of Bellefonte. When you reach Centre county you come within the centre of the Commonwealth of Pennsylvania, and when you locate in this town you are practically in the centre of the State.

We recognize the fact that of all the industries of this land agriculture is the leading one. In other words, it is the living industry of the age, it is the foundation upon which every other pursuit in this land must rest. When agriculture is prosperous, all other industries partake of its prosperity. When adversity strikes the farmer or his farm, it affects every other business in the land. So that there is no industry so potent and so important to all the other industries of our country as that of agriculture. It is the basis upon which the commercial and manufacturing interests of this Commonwealth rests. It is perhaps of all industries in the land the one most dependent upon the hand of Providence. From the day the farmer sows his seed in the ground until he harvests his crop and places it in the barn, every day in the season he is dependent upon a beneficient Providence for favor and prosperity upon his broad fields.

Farming is reduced to a science. You will discover this when you hear from our worthy friend of this town (Clement Dale, Esq.), in his essay upon Centre county farming. He may tell you how farming was done in this county fifty years ago. If he does, you will be very much surprised when you contrast it with the present method of farming in this county and surrounding districts. But for the essayist I desire to say he is termed with us *an ancestral farmer*, he farms through his fathers. He left the farm when he was fifteen years of age, and what he knows now of practical farming he gathers as *executor of his father's estate.* (Laughter.)

I might also say in this connection, referring to the local history of the distinguished member of your society of this town, and who is

present now, that he is also a farmer, but not in its practical sense. He farms per alium, or, as it is said in our law books, he is a farmer aliundè. We are not accustomed to call him "Farmer Hale," we distinguished him by the title "M. D." He is a physician of this town. And yet he is a successful farmer in this county, that he owns nearly all the land between this and Hublersburg. (Laughter and applause.)

Gentlemen of the Board, we are very glad to welcome you to our town. The interests of our county are very much like the interests of every agricultural county of this Commonwealth.

We have under the soil within our borders the richest deposits of iron ore of any place within the Commonwealth, except, perhaps, the Coleman estate in the county of Lebanon. We are building two large furnaces on the borders of the town, and the supplies for these furnaces of iron ore, coke and coal will all be derived from within county limits. We have very extensive glass works in successful operation; a short time since it met with a disastrous fire and was totally destroyed. It has been rebuilt, and to-day Bellefonte glass stands upon an equality with any other glass manufactured in this Commonwealth. We have also successful iron works largely engaged in the manufacture of nails, and there are other industries connected with the manufacture of iron. We have rich deposits of coal and iron ore, as I have already stated; the deposits of iron ore seem to be innumerable, and the supply inexhaustible. For a hundred years to come the iron interests of this country cannot be fully developed, much less exhausted. And we have not only our iron and lumber interests, but we have other manufacturing interests of importance. We have some of the very best mills, with the new process for the manufacture of flour, actively and prosperously engaged within the limits of this county, and within the limits of this borough.

We are, perhaps, as old a town as you will find in the interior of the Commonwealth. This town travels with the century. It was organized in 1793 by James Dunlap and James Harris, whose descendents largely are residents of this borough.

The first agricultural society was held in this town in 1825, and it was presided over by Judge Burnside, afterward of the Supreme Court, and who to-day is sleeping in our beautiful cemetery; so that for a period of sixty years and upwards this people has been engaged in the science of agriculture, and interested in the development of the country and the farm, and commencing at a period of time, gentlemen, when the Indian must have traversed the confines of our county.

You are to-day within sight of the Bald eagle's nest, the noted chieftain after whom our railroad and our valley of the Bald Eagle is called. You are in sight of Logan's spring, called in honor of the most noble of all the Indians of this country, and his war-path and the site of his camp are in this county; and not only this, but the great warrior's path leading from Erie to the Delaware, the Chinklodacamoose, is today a land-mark for some of the original surveys, an incontrovertible land-mark fixing the boundaries of unseated lands in this county.

Gentlemen, I desire to call your attention to the fact, and I do it modestly, that you are here at the home of the Chief Executive of this Commonwealth, who for some good reason is absent from your Board to-day. By virtue of his office, the Governor is President of this Board. I welcome you to his home. We all feel a personal pride in Governor Beaver, who so worthily fills the office of Chief Magistrate of this Commonwealth.

I am not in the habit of pronouncing panegyric or eulogy over the living, and yet I cannot restrain my thoughts and my feelings from saying that we are proud that it is also the home of the most distinguished living war Governor of the age. Governor Curtin is a resident of this town. I feel a personal pride in everything that is connected with his name, because of his usefulness to his country and his record as the War Governor of Pennsylvania. I might say that he is not only the peer of every living war Governor, but he is one of three surviving of the seventeen Governors who met in the city of Altoona during the war, upon whose determination depended very much the success of the Union arms, and if there is anything that the country should rejoice in, it is the memory of the men who in the trials of the country stood faithful to her flag (applause); we should honor them on all occasions, and we should be ready even in there lifetime to pronounce eulogy upon their name.

Governor Curtin occupies a peculiar relation to our court. He has pronounced within the last year a eulogy upon six or seven members of this bar; and, as he is in the prime of his life, he has promised to continue to pronounce eulogies upon the deceased members of this bar until, as he says, we are all buried (laughter).

There is one other matter of interest to which I desire to call your attention; we have in this town a most noted spring; its waters are pure and fresh and sparkling, and as clear as the midday light; so far as we know, since the creation, there has never been the first evidence of discoloration in a single particle of that water, then it is not only pure and fresh in appearance, but wholesome.

I notice that the president of this association at the commencement exercises of the *theological* seminary at Princeton the other day, in a post-prandial address, *complained* that the altitude of Princeton was so great that the atmosphere was exceedingly stimulating AND VERY DRY. Now, as to being dry, if any member of this association *indulges in the use of water*, we refer him to our spring as one that will furnish a refreshing draught of purest nectar or life. Furthermore, it is the only place in this town where you can be accommodated with a drink after ten o'clock at night.

I take pleasure in thanking you for your presence here, and most cordially extend you a welcome to our town and to the hospitality of our homes.

On behalf of the Board, Dr. John P. Edge replied as follows:

Judge Furst and Citizens of Centre county: It is a source of regret to every member of this Board present, that His Excellency the Governor, the President of the Board, is unavoidably absent. I was made aware of the fact only a few minutes ago that I would be required to preside in his absence, the senior vice president being also absent; and I have, therefore, no extended remarks to make in response to the very cordial address of welcome that you have just pronounced. The record of the proceedings of this Board during its present session must be a response to that welcome; and when that record shall have been completed, it will be for the citizens of Centre county, who have participated and listened to its proceedings and discussions, to decide whether we are entitled to the cordial welcome that we have received. On behalf of the Board I thank you for receiving us so kindly.

Present—Messrs. Dr. Edge of Chester, Dr. Atherton of Centre, Garrettson of Adams, Zerr of Berks, Reeder of Bucks, Scott of Bradford, Hale of Centre, Herr of Clinton, Eves of Columbia, Colvin of Lacka-

wanna, Engle of Lancaster, Barnes of Lehigh, Smith of Luzerne, Kratz of Montgomery, Clapp of Montour, Shimer of Northampton, Hoffa of Northumberland, Musselman of Somerset, Speaker of Sullivan, Searle of Susquehanna, Mather of Tioga, Gundy of Union, Gates of Venango, Miller of Warren, McDowell of Washington, Underwood of Wayne, Roland of York, Dr. Leffmann, Microscopist; Prof. Buckhout, Entomologist; Prof. Osmond, Meteorologist; and Secretary.

The chair named Messrs. Roland of York, Herr of Clinton, and Hoffa of Northumberland, a committee to receive and report upon the credentials of members elect and delegates.

In the order of new business, the question of the place of next meeting was considered; West Chester, Beaver, Reading, Lewisburg and Montrose were named, when, on motion, the selection was left for a subsequent session.

On motion of Mr. Smith, Wm. Gates of Venango, then read an essay on "How to Build and Maintain Public Roads," the subject matter was then discussed by Messrs. Dr. Edge, Searle, Engle, Herr, Underwood, McDowell, Gates, Roland, Hamilton, Frear, Kratz, Colvin, Secretary and others, when, on motion of Mr. Mather, the discussion was closed.

Dr. J. P. Edge of Chester, then read an essay entitled "An Inquiry into the Results of the Artificial Propagation of Food Fishes in Chester County," which elicited discussion on the part of Messrs. Roland, Shortlidge, Smith, Groff, Dr. Edge, Engle and Musselman.

On behalf of the Committee on Credentials of members and delegates, Dr. W. S. Roland presented the following report, which, on motion of Mr. Engle, was accepted.

"The Committee on Credentials report the following delegates present, viz: Muncy Valley Farmer's Club, A. J. Kahler and Abner Fague.

Clinton County Agricultural Society, James David, William Hayes, J. H. Long, Jacob A. Bittner and Charles Kyle.

Clinton County Pomona Grange, John McNaul, James H. Porter and I. T. Lundy.

Nittany Grange No. 334, John W. McClintock and Charles R. Romick.

Bald Eagle Grange No. 303, L. T. Lundy and wife.

Solebury Farmers' Club (Bucks county), Watson Kenderdine, W. C. Blackfan, Hannah Reeder and Lizzie C. Blackfan.

On motion of Mr. Searle, Prof. W. A. Buckhout, Entomologist of the Board, read an essay entitled "Some Suggestions on Forestry," which was followed by discussion from members and others.

On motion of Mr. Smith, Clement Dale, Esq., read an essay on "Farming in Center County."

On motion discussion deferred, and adjourned until 2 P. M.

WEDNESDAY AFTERNOON, *June 8, 1887.*

Board called to order at 2 P. M., by Dr. John P. Edge, Vice President, in the chair.

On the motion of Messrs. Herr and Barnes, the chair was directed to appoint suitable committees to prepare and present to the Board resolutions expressive of the feelings of the members at the death of J. S. Keller, late member from Schuylkill, and D. H. Foresman, late member from Lycoming. The chair named, in the case of the death of Mr. Keller, Messrs. Barnes of Lehigh, Zerr of Berks, and Shimer,

of Northampton, and in the case of the death of Mr. Foresman, Messrs. Herr of Clinton, Gates of Venango, and Eves of Columbia, with directions to present their reports at the afternoon session of Thursday.

On behalf of the Committee on Credentials, Mr. Herr of Clinton, reported that the committee had received a certificate showing that Robert A. Foresman had been selected by the Lycoming County Agricultural Society, to represent them for the unexpired term of D. H. Foresman, deceased. They further reported that inasmuch as the certificate was not upon the blank form prescribed by the rules of the Board, that they would recommend that he be received as a member for this meeting, and that previous to the next meeting he should furnish the Secretary with a certificate of membership made out upon the proper form. Report of committee adopted, and the Secretary directed to furnish Mr. Foresman with the proper blank.

On motion, John Hamilton of Centre county, then read an essay, on "Tenant Farming," which was discussed by Messrs. Roland, Gundy, Hamilton, Humes, Searle and Smith.

On motion of Mr. Engle, Hon. C. C. Musselman of Somerset, then read an essay entitled "Lime and Home-made Fertilizers *versus* Commercial Fertilizers."

On motion of Mr. Herr of Clinton, all discussion of the fertilizer question was deferred until after the reading of other essays bearing on the topic.

Hon. John W. Hickman of Chester county, then addressed the Board upon the subject of commercial fertilizers, and illustrated his remarks by a series of illustrated charts.

On motion of Mr. Eves of Columbia, seconded by Mr. Searle of Susquehanna, it was decided to invite Hon. A. G. Curtin to address the Board during the early portion of the session, and on motion the chair named Messrs. Eves, Musselman and Roland a committee to invite Governor Curtin to address the Board in accordance with the resolution of Mr. Eves.

Prof. Wm. Frear of State College, then read an essay on "The Results of Recent Investigations on Nitrogen in Soils and Plants."

On motion of Mr. Herr, the unfinished order of fixing a place of next meeting, and after several ballots it was decided to meet at Beaver at the call of the Advisory Committee.*

On motion adjourned.

WEDNESDAY EVENING, *June 8, 1887.*

Board called to order at 8 P. M., by Hon. John P. Edge, Vice President, in the chair.

In accordance with the programme, Hon. A. G. Curtin then addressed the Board.

Dr. Henry Leffmann, Microscopist of the Board, delivered an illustrated lecture upon "The Application of the Microscope to the De-

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* Soon after the adjournment of the Bellefonte meeting, it was found that from the fact that the court house would be in use during the month of September, it would be impossible to hold a meeting at Beaver at the time proposed; it was also found that there had been a misunderstanding as to the time of the proposed meeting.

In view of these facts, and with the advice and consent of the Executive Committee (obtained in writing) it was decided to call a meeting of the Advisory Committee for the purpose of taking such action as might seem advisable.

At the meeting of the Advisory Committee, after a careful examination of the question in all of its bearings, it was decided to hold the next meeting at Montrose, Susquehanna county, and October 12 and 13 was decided on as a date which would best suit the resident member and the members of the Board.

tection of Adulterations." The lecture was profusely illustrated by a camera, and was listened to by an appreciative audience.

THURSDAY MORNING, *June 9, 1887.*

Board called to order at 10 A. M., in the chapel of the State College, by Dr. J. P. Edge, in the chair.

Dr. George Atherton, president of the State College, then explained the programme for the day.

Dr. George W. Cook, director of the New Jersey Experiment Station, then read an essay on "The Limitations of Agricultural Experiment Work."

On motion, adjourned for the purpose of examining the different departments of the college, and the plots on the State Experimental farm connected with the college.

THURSDAY AFTERNOON, *June 9, 1887.*

Board came to order at 3.00 P. M., in the chapel of the State College, Dr. John P. Edge, Vice President, in the chair.

The committee appointed to prepare resolutions expressive of the feelings of the Board in relation to the death of D. H. Foresman, late member from Lycoming, reported as follows:

WHEREAS, Death has again invaded our organization and has removed from this Board of Agriculture one of its foremost and most influential members; therefore, be it

Resolved, That in the death of Hon. D. H. Foresman, late member from Lycoming county, this Board has sustained an irreparable loss. A strong and valuable member has been taken from us, whose long and useful connection with this Board, whose great social characteristics and sterling qualities of head and heart had greatly endeared him to us.

Resolved. That while we humbly submit to the Divine fiat we mourn the loss of one whose private and official connection with the Board has been distinguished by the zeal and ability which he brought into its labors.

Resolved, That we tender our earnest sympathy to the bereaved family and friends; and

Resolved, That a copy of these resolutions be presented to the family of the deceased and be spread upon the minutes of this Board.

[Signed] J. A. HERR,
WILLIAM GATES,
CHANDLEE EVES.

The committee appointed to prepare similar resolutions relating to the death of Joshua S. Keller, late member from Schuylkill county, presented the following:

WHEREAS, This Board having been informed of the death of Joshua S. Keller, who has represented the Schuylkill County Agricultural Society as a member of the State Board of Agriculture since its organization, in the year 1877, continuously to the present time, having in January last been reëlected for another term of three years from that date; therefore,

Resolved, That by his death Schuylkill county has lost a worthy and efficient citizen and faithful representative in the State Board of Agriculture, in the Agricultural Society and in the State Horticultural Association.

Resolved, That as a Board we hereby express our sympathies and condolence with the family under their bereavement by the loss of husband and father who was long spared to them, even beyond the allotted time, three-score and ten years, but now. by the unchangeble providence of God, removed in the way of all flesh.

Resolved, That a copy of these resolutions be transmitted to the family and that they be enrolled in full on the records of the Board.

[Signed] JAMES P. BARNES,
A. D. SHIMER,
JACOB G. ZERR.

The President having requested an expression of the feelings of individual members the following responses were given:

Dr. W. S. ROLAND of York. My acquaintance with the deceased members, J. S. Keller and D. H. Foresman, commenced with the organization of this Board of Agriculture, ten years ago last January, and that membership and association has continued uninterruptedly down to the close of their useful lives. It is honorable for the living to speak of the virtues of the dead and to express sorrow, and to pay tribute to their memory, and to do justice to their merits, whereby gratitude, truth and friendship are served, and the example rendered worthy of the emulation of the living.

The deceased were agreeable and pleasant companions; they were attentive, active and energetic, and took great interest in the business of the Board, and by their careful, intelligent and strict attention to their relative duties, and by their uniform courtesy and kindly dispositions endeared themselves to their fellow members. In their intercourse with their fellow associates and friends they were uniformly urbane, respectful, and always easily approached. Warm in friendship and sincere in their convictions, they enjoyed the respect and confidence of all who knew them.

Mr. Keller was a plain practical man, rather unassuming, but when he did take part in the proceedings he was consistent, and what he did say showed intelligence and sound judgment. His absence from the meetings will be mourned.

Mr. Foresman always took an active part in the discussions of the various topics introduced into the meetings, and was ever ready and prepared to say something intelligently to the purpose. He was ambitious in action, never wearying in seeking for successful results, and his words and influence were respected by his fellow members as possessing thought and ability. I most sincerely lament the untimely loss of an associate and friend, thus cut down in the midst of an active, busy and useful life.

Col. H. C. DEMMING. J. S. Keller had a very strongly marked individuality. Of all the men the members of this Board have met, not one can be brought up in memory as resembling the gentleman referred to. His dress, his manners, his conversation, his general ideas of men and things, all appeared in decided contrast with the generality of men. He believed more in the homely home-spun than later cuts in fashion, though in this respect he was not so far behind as to call forth disparaging remarks or unfavorable criticism from strangers or acquaintances. In manners he would not attract special attention mingling with a number of farmers, unless by his habit of sitting more or less isolated from others in the meetings he regularly attended, dropping low down in his chair, and now and then, without regard to parliament-

ary law, uttering a word or suggestion, or even making a motion as the occasion seemed to warrant. I have noticed the effect of this upon former Presidents of the board, particularly ex-Governors Hartranft and Pattison. The first mentioned at first seemed to be taken completely by surprise; but after making himself acquainted with the sterling qualities of the member from Schuylkill, he always treated him with courtesy and respect, though evidently a little worried at times when strangers of note were present. When ex-Governor Pattison had presided over the deliberations of the Board one or two sessions, he had heard from our friend two or three times in the unexpected manner I have indicated. At first he evidently thought he was not a member of the Board; but, having inwardly decided that he was, he then proceeded to investigate him mentally. For perhaps half an hour the presiding officer sat with his eyes fixed on the Schuylkill representative, minutely observing every movement, and seemingly reading his very thoughts. What his conclusion was never was communicated; but from that time forth whenever a remark or suggestion or motion came in the unparliamentary way alluded to, if it could be received without too apparent inconsistency with the subject under consideration, it was invariably entertained.

In conversation one soon was convinced with the fact that the deceased had devoted much time to study and investigation, and was in advance of many supposed-to-be well educated agriculturists. He seldom spoke at length during the sessions of the Board, perhaps not six times in the ten years of his membership, but what he did say was usually sound and to the point, and on one or two particular occasions quite important. He was outspoken in his sentiments, and a man of very strong convictions. When he made investigations they were characterized by intelligence and much patience. The results were communicated to his neighbors and others without restraint; and I think this accounts for his great popularity at home.

He was not only regular in attendance upon the sessions of this Board, but as a member of the State Agricultural Society and of the Executive Committee thereof he seldom omitted a meeting. He took a deep interest in everything pertaining to agriculture, he seemed to care little for anything else, the cultivation of strawberries and the stocking of his fish pond with carp being considered branches of that science.

As a man he was honest, large-hearted, generous, kind to his fellows without exception, punctual in his engagements, seemingly regular in his habits, and in hearty accord with the progress of the age. He never carped about the "good old times," but ever seemed to look upon the present as in advance of the past, aiding in various directions to the best of his ability until he sank into his last sleep.

About fourteen years ago it was my good fortune to become acquainted with one who will live long in the memory with the older members of this Board (Hon. D. H. Foresman). He was unlike other members of the Board in some respects. While regular in his attendance upon the meetings, he usually sat aside or further back than the other members; and when discussion lagged or appeared dry, or not to the point, a few words would be thrown in, combating something that had been said, thus bringing several members to their feet in reply. Thus new life would spring up, and more than once the matters drawn out proved of great additional value in the published proceedings. In going to and returning from the sessions of the Board, when our departed friend was on the train, time passed much more

pleasantly and agreeably, particularly before he suffered from the poor health that was apparent the past year.

Mr. Foresman was a man of strong likes and dislikes. Some men he seemed to care very little for; others commanded perhaps only his respect. If true merit were discovered, no man was more willing to acknowledge it than he. With merit, ability and tact combined, then not only respect and attention, but admiration would follow.

He was a strong partisan. From early life he remained unswervingly of the same political faith, but consenting to hold positions by the franchises of his fellow citizens in local offices only, and with small or no pecuniary remuneration.

He was a man who led in sentiment at home, and had great influence with his neighbors. While watchful monetarily, and to a degree noticeable by strangers, he had a quiet way of helping the needy that very few knew until his decease. After the funeral numbers of persons came to the afflicted wife, or sons, or administrator, acknowledging with deep gratitude help which had been extended. Widows and orphans and numerous poor neighbors had had the helping hand without knowledge of any other member of the family than the husband and father.

He was an enterprising citizen. A number of the most prosperous industries of Williamsport are largely due to his business sagacity and foresight. In agricultural pursuits he pushed with vigor the work on the large thriving farms that he owned. He seldom made a mistake in connection with their operation; but when he did it was amusing as well as entertaining to hear him relate how it happened, and how it was rectified.

Jovial in manner, apparently careful in habit, strongly attached to his home and family, clear and outspoken in his beliefs, free from cant and hypocrisy, hospitable and kindly disposed to friends and acquaintances, ever keenly interested in the welfare of this Board, and active for its permanent good, this association has suffered a great loss in the departure forever of one of its oldest members, sincerest friends and warmest advocates.

Hon. C. C. MUSSELMAN of Somerset. Mr. President: Permit me to say a few words in memory of J. S. Keller. I heartily endorse the resolutions offered relative to his life and services. I do not believe that any member of this Board will be more missed than he; not on account of his usefulness, but on account of his frank though peculiar manner. I believe that this Board never fully appreciated his worth. He had more than ordinary information on the subject of farming. He belonged to a class of farmers second to none in this great country of ours. He was one of Pennsylvania's Dutch farmers, to which class I have the honor to belong. He said but little, but generally it was to the point. He was a plain, unassuming gentleman, and I, for one, feel very sorry for the loss of our friend J. S. Keller.

J. P. BARNES of Lehigh. Mr. President: I have but a few words to say in addition to what has been so well said. My acquaintance began since the time these gentlemen have referred to, as my first engagement in connection with this Board of Agriculture was after the first meeting in the year 1877. I formed the acquaintance of these members from the beginning, and at once associated with them to a greater or less extent. Mr. Keller was a man of very peculiar impressions. He was honest and sincere in whatever he did. He was not a theoretical man, but whatever he presented to the Board he presented as

obtained by practical experience; and that was perhaps of more effect than if he had merely got up and given us some theoretical explanation. This practical part he always clinched by his experience, and thereby effectually convinced the Board. He was peculiar in his habits, as I said before, and reticent in some respects, but the remarks he made were generally to the point.

I formed the acquaintance of Mr. Foresman at the same time. In my acquaintance with Mr. Foresman I obtained a strong friend. He was a man who made impressions on you at once, and, as had been said, his likings were strong. When he became attached to a person he was very frank and free in his expressions, and very communicative. As regards his private affairs and his public life in connection with this Board, these things have been referred to so fully that I can add nothing to what has been said. But I will say that this Board has lost two excellent members. They were men of different temperaments and different in character, but each in his own sphere filled a position in this Board that cannot be easily replaced. I agree fully with what has been said by my predecessors, who have so ably spoken in memory of the deceased.

E. REEDER of Bucks. Mr. President: I remember that Mr. Foresman and I came into this Board together on the 22d of May, 1877. There were nine of us who presented our credentials and were admitted that day. Of the number only three now remain in the Board, Dr. Barnes of Lehigh, Professor Wilson of Juniata, and myself. I formed Mr. Foresman's acquaintance ten years ago, and it has been kept up pleasantly ever since. He has been three times elected Vice President of this Board; and I can say when he presided over our deliberations he did it with ability and dignity, and his decisions, so far as I was able to judge, were always just and impartial. As an essayist or a reporter, he does not appear conspicuously in the publications of our proceedings. He appeared to have a dislike to that kind of work, and the labor which is necessary to present a lengthy report or to enter into a statistical calculation. But what we valued him for was the words of approval and encouragement which he so promptly tendered after these reports had been made. I shall always hold in grateful remembrance the promptness with which he came to my succor on one occasion.

I first received the news of his death in the programme announcing this meeting, and it filled me with feelings of surprise and sorrow. I think that in his death we have lost a most valuable member.

H. L. SCOTT of Bradford. Mr. President: I cannot allow this occasion to pass without expressing my hearty approval of the sentiments exhibited in the language of those who have responded. This Board has lost two members, and men who have been of value to it almost from the time of its organization, and this is a fitting occasion for this Board to give expression to its feelings relative to their loss. Between seven and eight years ago I first formed the acquaintance of Mr. Foresman, and became better acquainted with him afterwards perhaps than with any other member. I had intended to make some remarks in relation to his decease, but I find that what I contemplated saying has been so much better said by others, and the ground so well covered, that I can add nothing. The thoughts it is true have been clothed in somewhat different language, but they have so thoroughly expressed my views that I will not take the further time of the Board than to say that I am heartily in accord with the senti-

ments of the resolutions, and believe with you all that the Board has lost two valuable members.

THURSDAY EVENING, *June 9, 1887.*

Board called to order by N. F. Underwood, in the court house at Bellefonte, at 8.00 P. M., June 9, 1887.

Prof. I. Thornton Osmond, Meteorologist of the Board, then delivered an illustrated lecture on the "Physics of the Atmosphere."

On behalf of a previously appointed committee, Dr. W. S. Roland of York, offered the following resolutions, which were unanimously adopted:

WHEREAS, The spring meeting of the Pennsylvania State Board of Agriculture being now about to close, it is proper that we should put on record a formal expression of our satisfaction at our reception in Centre county; therefore,

Resolved, That the thanks of this Board are hereby tendered to the citizens of Centre county, and particularly to the Hon. A. O. Furst, Hon. A. G. Curtin and Dr. E. W. Hale (resident member of the Board) for the cordial reception and interest which has been shown in our meeting, and for the assistance which has been rendered by contributions of papers by the residents of the county; and

Resolved, That we are indebted to the trustees and faculty of the Pennsylvania State College for a day's pleasure and instruction gained in visiting their institution, and that we are highly pleased at the active and effective work in instruction in both the science and mechanic arts which is being carried on at the College; and

Rsolved, That we tender our thanks to the management of the Bellefonte and Buffalo Run Railroad Company for the courtesy of transportation to and from the College.

[Signed]

WM. S. ROLAND,
HENRY LEFFMANN,
R. S. SEARLE.

On motion adjourned to meet at Beaver at the call of the Advisory Committee.

MINUTES OF THE AUTUMN MEETING.

Held at Montrose, Pa., commencing October 12, 1887.

WEDNESDAY, *October 12, 1887.*

Board called to order at 10 A. M., by Dr. John P. Edge, Vice President, in the chair.

Present Dr. J. P. Edge and Messrs. Garretson of Adams, Zerr of Berks, Scott of Bradford, Herr of Clinton, Eves of Columbia, Hiester of Dauphin, Colvin of Lackawanna, Barnes of Lehigh, Clapp of Montour, Smith of Luzerne, Kratz of Montgomery, Shimer of Northampton. Hoffa of Northumberland, Speaker of Sullivan, Searle of Susquehanna, Gundy of Union, Miller of Warren, Reeder of Bucks, Powell of Crawford, Underwood of Wayne, Roland of York, Oliver of Crawford, Dr. H. Leffmann and Secretary.

Obituary notice of Hon. C. C. Musselman was read, and on motion of Mr. GARRETSON, the chair named a committee consisting of Messrs. Garretson of Adams, Hiester of Dauphin and Leffmann of Philadelphia, to draft resolutions expressive of the feelings of the Board and to present them at the opening of the evening session.

The Chair named Messrs. Barnes of Lehigh, Roland of York and Eves of Columbia, a committee to receive and report upon the credentials of members elect and delegates.

Minutes of spring meeting read by Mr. Hiester, and after correction, approved.

The Committee on Credentials reported that Peter Reeder, Esq., presented certificate of election as the member of the Board from Lycoming county, and that he was entitled to a seat as such; on motion, the report of the committee was accepted and Mr. Reeder admitted to a membership in the Board in the place of Hon. D. H. Foresman, deceased. The committee also reported that R. J. Page, S. E. Morse and F. L. Williams, were present as delegates representing Grange No. 342, of Patrons of Husbandry, and were entitled to seats as delegates; report accepted.

List of standing committee called, and on behalf of the Committee on Silk and Silk Culture, Dr. BARNES, chairman, presented a full report, which the Secretary was directed to publish in the annual report of the Board. The subject matter of the report was fully discussed by Messrs. Roland, Edge, Hiester, Barnes, Zerr and Searle.

At the suggestion of the Secretary, the question of the time and place of the next meeting was taken up, when, on motion of Mr. GUNDY of Union, it was resolved to hold it at Lewisburg, December 7 and 8, 1887.

On motion of Dr. LEFFMANN, for the purpose of shortening the programme for the afternoon session, Dr. W. S. ROLAND of York, read an essay upon "Home Life on the Farm," which was fully discussed by Messrs. Garretson, Gundy, Herr, Zerr, Leffman, Speaker, Powell and Barnes.

On motion, adjourned to meet at 2 P. M.

WEDNESDAY AFTERNOON, *October 12, 1887.*

Board called to order at 2 P. M., by Capt. M. W. Oliver, Vice President, in the chair.

On motion, Mr. HIESTER, chairman, of the Committee on Fruit and Fruit Culture, read the report of that committee, which elicited discussion from Messrs. Searle, Hiester, Powell, Zerr, Warren, A. O., Scott, Camp, Oliver, Miller, Tilden and Secretary.

Mr. HERR read an essay entitled "The Pro and Con of Fruit Growing," which called out discussion from Messrs. Searle, Hiester, Powell, Zerr, Herr, Roland, Oliver, Miller, Tilden, Davis, Speaker, Reeder Gundy, Dr. Edge, Colvin, Leffmann and Secretary.

Owing to the absence of local essayists it was decided, upon motion of Mr. BARNES of Lehigh, to take up the regular programme of the afternoon, when Mr. REEDER of Bucks, chairman, read the report of the committee on Dairy and Dairy Products.

On motion, Mr. OLIVER of Crawford, read an essay on "A Higher Standard in Dairying."

EDWARD BRINTON of West Chester, Pennsylvania, then read an essay on "Practical Dairying," when, on motion of Mr. BARNES, the subject of the report of the committee, the essays and the whole subject of dairying was declared open for general discussion, which was participated in by Messrs. Reeder, Eves, Hiester, Wells, Carter, Searle, Speaker, Barnes, Colvin, Dr. Edge, Gundy, Leffmann and Hoffa.

On motion, adjourned until 7.30 P. M.

WEDNESDAY EVENING, *October 12, 1887.*

Board called to order at 7.30 P. M., by Hon. N. F. Underwood, Vice President, in the chair.

On behalf of the Committee on Resolutions, referring to the death of Hon. C. C. Musselman, Dr. Leffman reported as follows:

"WHEREAS, This Board has received with much sorrow and regret, the intelligence of the death of Hon. C. C. Musselman of Somerset county, who has for so many years been a member of this Board;

"*Resolved*, That in his death this Board has lost one of its most active and industrious members; one who during the entire time of the Board has been ever ready to contribute to the interest and value of its meetings;

"*Resolved*, That by his faithful performance of duty, courteous manners and genial disposition, he had won the respect of every member of the Board, and that by his death Somerset county has lost a worthy representative;

"*Resolved*, That we tender our sympathy to the members of the family of the deceased in their bereavment, and that a copy of these resolutions be transmitted to them, and spread on the minutes of the Board."

Signed, I. Garretson, H. Leffmann and G. Hiester, committee.

The Chair having declared the resolutions before the Board for general discussion, and having asked for an expression of the feeling of the Board, members responded as follows:

JOHN P. EDGE of Chester. It is proper that something be said in memory of Hon. C. C. Musselman, and I therefore move the adoption of the resolutions, and in so doing I wish to express my sorrow, in common with others, at the loss we have met with.

Those who were present at our June meeting at Bellefonte, will re

member his expression of feeling at the death of our late members J. S. Keller and D. H. Foresman, and we little thought that we so soon should be called upon to perform a like service for his memory. They will also remember that the last one to pay his tribute to the deceased members was Judge Musselman of Somerset. I can say of him that he was a toiler in our Board; a man of many social impulses, and thoroughly honest in all of his impulses; a warm friend and perhaps as warm in his antagonism when thoroughly aroused; faithful to his duties and always earnest in fulfilling them.

The records of the Board are a proof, in very many instances, of his intelligent performance of duty and of his painstaking in the preparation of essays, papers and reports; such were always prepared with much care and exhibited careful thought and a purpose to do the work as near right as was possible. When we take these things into account we cannot, perhaps, be too strong in our expression of regret at his loss. I certainly feel that we have lost a very warm and kind friend.

W. S. ROLAND of York. I did not intend to make any remarks this evening, but my acquaintance with and knowledge of Judge Musselman was of such a character that I can but rise and express them. As has been remarked by Dr. Edge, it was but a few months ago that I met Mr. Musselman at the Bellefonte meeting in the fullness of health and as happy as any one could be; now he has been called hence. It is only an assurance to us that are left of the uncertainty of life and the certainty of death. Judge Musselman was a man who was bold in his thoughts as he was fearless in their expression, but he was honest and he was intelligent. His social qualities were of such a class as to endear him to all with whom he had any social relation. He was a gentleman who was beloved, and my acquaintance with him has extended nearly the whole time of the existence of our Board; he was a practical man and an honest one

J. A. HERR of Clinton. IfI did not add a regret to those already expressed at the loss of our friend and fellow member, Judge Musselman, I would do violence to my feelings as a man. I have always regarded him as one of the strongest and most zealous, as well as one of the most able and active members of our Board. A man whose private character was above reproach, an example to us all and a model in all respects. As a man of morality, of christian virtue, he was exemplary; as an earnest, practical worker he never shirked duty as the minutes and proceedings of the Board will show, having taken part in our discussions as often as any other member. He was prompt, always on hand and ever r ady for duty, and our Board had no more able defender than Judge Musselman. May we all be able to make as good a record.

J. P. BARNES of Lehigh. Mr. President and fellow members of the Board, I will add but a few words to what has already been offered in relation to our former member. I knew him since his connection with the Board in 1878. My acquaintance with him was such as was agreeable and pleasant, and I always looked forward to our meetings as an opportunity of associating with him. As has been said, he was a member who was fearless and conscientious in his actions and always ready to do his duty as he understood it. He was one who took great interest in the work of the Board and seldom failed in his attendance at its meetings, and his character was above reproach.

His intentions were christian like in purpose and always received

the respect of those who associated with him. During the nine years that we have been connected with the Board the number of essays which he has written attest the interest which he took in our work, and his participation in our debates also attest this interest. The expression of his essays called forth the good will and good feeling of all who were associated with him. He is the sixth member of our Board who has departed since our organization, and as we grow older we must expect these inroads upon our numbers; we must examine ourselves and for ourselves answer the important question, "Are ye also ready?" We cannot say who the next one may be, but some one must surely follow and be removed from connection with us. All that has been said in praise of Judge Musselman I can heartily indorse, and we all regret his loss.

N. F. UNDERWOOD of Wayne. We are again reminded of a loss in the membership of our Board, and looking back over the past I can well remember my first meeting with this Board in January, 1879, and my recollection of the members who then composed it are very distinct; it has seemed to me that it has never been my fortune to meet with any body of men who displayed such marked individuality as did the then members of our Board. Those of you who were present at that time will agree with me that in respect to those who have gone, Mr. Beebe, Mr. Keller and now Judge Musselman, were all marked with strong individuality. One thing which is true of Judge Musselman, and which has not yet been alluded to, is that he was always ready upon all proper occasions to uphold the dignity of labor and he never would allow, without protest, any reflections upon those who labored with their hands, and he used often to state that he was not only a farmer in theory, but also in practice, and that he was not ashamed of it.

Mr. Musselman's conscientiousness has been alluded to, and I can bear willing testimony to it; it never seemed to occur to him whether his opinions were those of the majority or not; he formed his own opinions of the fitness of things even though he should stand alone in advocating them. While it has been my fortune at times to disagree with him, I can say that he never suffered that disagreement to interfere with friendship or cause resentment.

I. GARRESTON of Adams. The death of C. C. Musselman was a severe shock to me, and I received my first intimation of it from a copy of the printed program of this meeting. He was a man who was true to his own judgment, slow to form an opinion, but having formed it, ever ready to defend it against all attacks or doubts.

He was practical in the full meaning of the term, and was always upon the side of labor in all discussions before our Board; he was one of our most regular attenders, and when in health never missed one of our meetings; he was always ready to comply with any duty assigned him, and was at all times willing to participate in our discussions, and a glance at our reports will convince any one that he was one of the most efficient and valuable members. His work is done and he has gone to his reward, having always advocated what he believed to be right and just, without fear or favor to any.

On motion, the resolutions were unanimously adopted and the Secretary directed to furnish the family of the deceased with a copy, and to incorporate them in the minutes of this meeting.

Dr. HENRY LEFFMAN, Microscopist of the Board, then delivered an interesting lecture upon the "Spectroscope and its use in Detecting

Adulterations," which was listened to by a large and appreciative audience.

On motion, adjourned until 9.30 Thursday morning.

THURSDAY MORNING, *October 13, 1887.*

Board called to order at 9.30 A. M., by Capt. M. W. Oliver in the chair.

JOHN I. CARTER of Chester county, read an essay on "Milk Separation by Centrifugal—and Milk Tests," which called out questions and discussion by Messrs. Underwood, Carter, Oliver. Brinton, Barnes, Clapp, Hoffa, Reeder, Camp, Dr. Edge and Secretary.

Dr. JOHN P. EDGE of Chester, then read an essay on "Underground Currents and Their Surface Indications," the subject matter of which was discussed by His Excellency Governor Beaver and Messrs. Barnes, Weston, Scott, Herr, Oliver, Searle, Tewksbury, Smith and Secretary.

The question of the influence of forests upon rainfall and climate, having been incidentally brought into the discussion, it was, on motion of Governor BEAVER, seconded by Mr. GARRETSON of Adams, resolved that the Chair name a committee of three to draft a request that Professor Lesley of the State Geological Survey, devote a portion of one of his reports to the subject of rainfall and water supply of farms. As such committee the Chair named Messrs. Dr. Edge, Searle and Eves, who afterwards reported the following:

WHEREAS, In the discussion of the paper of Dr. J. P. Edge, on "Underground Currents and their Surface Indications," as they relate to the subject of domestic water supply. His Excellency Governor Beaver requested that the attention of the State Geological Survey be called to the importance of the question, therefore be it

Resolved, That the Secretary be instructed to convey to Professor J. P. Lesley, chief of the State Geological Survey, the desire of this Board that he shall prepare. as a portion of the work, a paper on "The Underground Water Supply of the State." Adopted unanimously.

E. L. WESTON of Brooklyn, Pa , then read an essay on "Apples—their Variety and Culture," which caused discussion from Messrs. Barnes, Weston, Scott, Herr, Oliver, Searle, Tewksbury and Governor Beaver.

G. R. RESSIGUIE of Brooklyn, Pa., then read an essay on "Methods and Profits of Strawberry Culture," and CHARLES S. STEARNES of Harford, one on "Strawberry Culture," the subject matter of which was discussed by Messrs Dr. Edge, Powell, Smith, Hiester, Resseguie and Secretary.

On motion, adjourned until 2 P. M.

THURSDAY AFTERNOON, *October 13, 1887.*

Board called to order at 2 P. M., by His Excellency Governor Beaver, in the chair.

On motion, H. W. Kratz of Montgomery, read an essay on "The Construction and Mending of Public Roads."

On motion, the regular order for the afternoon session was resumed, and Colonel D. W. Searle welcomed the Board to Montrose, as follows:

General Beaver and gentlemen of the State Board of Agriculture:

I have been selected to bid you a hearty welcome to Susquehanna county, but as far as the Governor is concerned. the sea of upturned faces of citizens of Susquehanna county who were assembled at Hallstead to-day to celebrate the one hundredth anniversary of the first settlement of the county, greeted him with a better and more hearty welcome than any words of mine can express. Their smiling faces and ringing cheers proved their love and respect for James A. Beaver, the man, as well as confidence and respect for James A. Beaver, the Chief Executive of this State.

Gentlemen, you are the official agricultural representatives of the great State of Pennsylvania—a Commonwealth whose extent of territory, wealth and population might well entitle it to be called a nation. It is our proud boast that the State founded by Penn obtained the title to her soil from the aborigines by purchase, and that we are guiltless of the force and bloodshed with which the land of all the other States were wrested from their first possessors. Pennsylvania has within her borders Philadelphia, that busy hive of manufacturing industries, where more of her citizens own their homes than in any city in the world—Philadelphia, rich in patriotic and historic renown. It was there that that great declaration of human rights was given to the world; there that that matchless constitution which cemented feeble colonies into a peerless nation was framed. The various Legislatures of our State have from time to time in their wisdom passed laws fostering and protecting our mining and manufacturing industries, and as a result the State is a hive of industry from one end of her broad domain to the other—a domain so broad that, as Governor Beaver said this morning in his address to the children of the graded school, "no man has ever seen the whole of it;" and when we think of its vast extent and the limited life of man, no one can ever see all of its hills and valleys.

Pennsylvania is known and celebrated throughout our nation and the whole world for the development of her mining and manufacturing industries, while she is scarcely known beyond her borders as a great agricultural State, and this in the face of the fact that more of her citizens are engaged in that labor which produces the bread of life than in all other industries combined. While our Legislatures have been justly mindful of the necessity of aiding in the development of our mineral wealth, and of the necessity of removing burdens from manufacturing industries, they have given but little attention to this greatest of all our industries, and whatever advancement has been made in the development of our agricultural resources has been made without State aid.

Susquehanna county is an agricultural county. There is no man within her borders engaged in business of any kind but who is dependent upon the prosperity of this great industry for his own success. If the crop of the farmer is a failure, the merchants, ministers, doctors and lawyers are all alike hard up. The State Board of Agriculture is the creation of measurably recent legislation. I imagine that its province and duties extend far beyond the assembling together and reading essays upon the best means of raising different cereals. The State has in a measure committed to your hands a supervision of the interests of our industry of industries, and every thing that can advance the interests of agriculture should receive your careful attention.

Our State government has rightly aided in bringing the products of

our mines and manufactories to their markets, but there is something radically wrong in the results of legislative action when the farm products of the far west can be transported by the doors of farmers of Susquehanna county to our eastern seaboard cities on railroads chartered and protected by our State cheaper than can the products of our own Susquehanna county farmers. This wrong calls for legislative remedy.

Gentlemen, we welcome you here to-day in the hope that your presence here shall prove the herald of a brighter day for the farming interests of our county and State.

To which Governor Beaver, as President of the Board, replied as follows:

Ladies and Gentlemen. It is usual upon occasions of this kind to have the address of welcome and its appropriate reply at the commencement of the exercises. In this case this relation has been reversed and they are brought in at the close of the work. I, however, now see many advantages in this variation from the general plan. I can now respond for my brethren of the Board very much better than I could have done at the opening of our meeting yesterday. At the end of a visit we are in a much better position to judge of the extent and character of our welcome, and, therefore, it is much easier for me to reply now.

From what one of the bachelor members of our Board has said to me, I may judge that some of them wandered around your streets somewhat aimlessly last evening. One of them, who unfortunately has no one at home to take care of him, informs me that he walked around the town looking in at the open windows and pleasant homes, and saw no one, and he returned to the hall a little disappointed with his welcome.

Colonel Searle has very correctly intimated that if you had been with me at the centennial celebration at Hallstead yesterday you would have realized the fact that if there was anything deficient in your welcome here it was due to the fact that all the citizens of Montrose were at the Hallstead celebration. The deficiency which our bachelor member has noted was owing to the fact that the citizens were not here, and it was not due to any lack of welcome upon their part.

Now, I have been here before, and I knew that there would be no lack of welcome upon their part, and had you adjourned yesterday and gone with me to Hallstead you would have there received as royal a welcome as anywhere in the Commonwealth, and, after your other meetings in other parts of the State, this is saying a great deal. The people were gone, the ladies were gone, and our two bachelor members should have been with me at Halstead where the Montrose ladies were.

Now, suppose that we had been here yesterday morning at the opening session, and I had been compelled to reply to the kind words of Colonel Searle then, I would, of course, have told you how glad we were at our welcome to Montrose, how nicely we had been entertained, and how we had enjoyed ourselves here; but there would not have been anything in it, for it would have been at the very commencement of our visit. Now, if our wandering brethren of last night will but turn their faces to the audience, I can assure them of a right royal welcome from those whom they last night seemed to think were deficient in this respect, and if they will go around this evening and make themselves known, I will assure them of a welcome which will

fully compensate them for their disappointment last evening; but the trouble is that they and you will leave on the five o'clock train and will miss it all again. Having been here before, I can assure you of the cordiality of the welcome which you have missed by unfortunately holding your meeting at the same time as the centennial celebration at Hallstead. If your meeting had been held a little earlier in the autumn, while the golden foliage was still on the trees, a golden welcome would have awaited you. You missed that too.

As I drove over from New Milford with my friend Grow this morning, we saw the piles of Baldwins, Greenings, Pippins, Seek-no-furthers, Spice, no doubt of the King of Tompkins County, of which we have just heard so much. They gave us the promise of an entertainment next winter, when they have come to their perfection, when we sit down by the fire at evening, or at the table at meal time, or eat them in the form of apple-sauce, which is said to have been the favorite dish of one of our Governors. The wealth thus spread out before us during our ride over here was an indication that if we send up to Susquehanna county, and send the cash along with the order, we can have all the apples we want.

Col. Searle has said, and truly, that the State Board of Agriculture is designed not only to contribute to the intellectual culture and education of the farmers of the State, but that it is also designed, in a certain sense, to legislate for this same important interest. I do not, of course, mean by this that you are to pass laws and exact statues; but I do mean that if the State Board of Agriculture, with due deliberation, arrives at definite conclusions in relation to the different agricultural interests of the Commonwealth, that these conclusions must and should receive at the hands of our law-making power the attention and influence which they so well deserve. Representing the agricultural interests of the whole Commonwealth, as you do, you are bound to receive at the hands of the Legislature and the Executive that consideration to which the great interest which you represent is entitled; when you wisely legislate within the powers of your Board, and arrive at conclusions and make these conclusions known, you may feel certain that they will receive a favorable recognition; if you have not thus made your power and influence felt the fault is your own, and is due to the fact that you have not made the agricultural wants of the farmers known to the Legislature and to the Executive.

I believe that this Board contains the best thought of the interest which it represents, and is entitled to an influence second to no other power. You have a broader sphere than the mere meeting together with the people of the State to discuss agricultural topics and practices (valuable as this is); you represent, as Col. Searle has truly said, one of the greatest interests of the Commonwealth, and you have the largest constituency of any body except the Legislature itself.

I would say to the good people of Montrose that we fully appreciate the interest which they have shown in our work during our meeeting here, and that we believe that their hospitality is fully equal to their altitude, and that is saying much. I believe that there is only one other county besides this which is as high above sea level; I believe they claim that in Somerset they exceed Susquehanna in altitude, and perhaps in Sullivan they may claim as much; they also claim as good grass as you have. They have the same interests as you have and are represented in this Board just as you are.

Gentlemen, we welcome you to our meetings and express our re-

grets that owing to your centennial you were not able to attend all of our sessions. We appreciate the importance to the county of Susquehanna of this centennial at Hallstead, and can only hope that when we again meet here we may have no such exercise to detract from our work and meeting.

So far as my own experience goes I have never attended a meeting of the Board that I did not learn something of value from its practical papers and discussions, and there is not a man or woman in the State who might not have learned something from your discussions of yesterday and to-day; something of profit and value even in the cultivation of but a small patch of strawberries or potatoes. We heard this morning essays and discussions of practical usefulness that I have not heard excelled anywhere; they were practical and can be fully appreciated by all practical farmers; they contained not mere theory but were evidently the result of the practice of men who knew what they were writing and talking about. While these essays and discussions are put into proper shape and printed, yet they do not have that widespread circulation among the farmers of the State that they should have and that their value entitles them to.

Now we have further exercises upon our programme, and in order that we may complete what we have before us, we will now proceed to the consideration of the general question of the construction and repair of public roads, and on behalf of the Board, and in accordance with our rules, I cordially invite you all to participate freely in the discussion and let us understand fully what the farmers of Susquehanna county want in this special and important direction.

The general discussion of the road question was then declared open, and was participated in by Messrs. Searle, Tewksbury, Curtis, Barnes, Smith, Oliver, Carmalt, Tilden, Herr and Garretson.

J. F. BUTTERFIELD, D. V. S., then read an essay on "Breeding Hereditary Diseases," which was discussed by Messrs. Smith, Carmalt, Curtis, Eves and Secretary.

Dr. W. S. ROLAND of York, then offered the following:

"WHEREAS, The autumn meeting of the Pennsylvania State Board of Agriculture will now soon close, it seems proper that we should put upon record an expression of our gratification and satisfaction at our kind reception in Susquehanna county; therefore

"*Resolved*, That the thanks of the Board are hereby tendered to our resident member, R. S. Searle, for the satisfactory arrangements provided for our pleasant meetings, and for our personal entertainment and comfort at the Trabell House, and to the citizens of Montrose and of Susquehanna county for their kindness, attention and contribution of interesting and valuable papers and discussions at the meetings of our Board.

"*Resolved*, That the address of welcome by Colonel D. W. Searle of Montrose, and the response by our President, Governor Beaver, command our highest esteem and thanks.

(Signed,) WILLIAM S. ROLAND,
J. P. BARNES,
L. B. SPEAKER."

R S. SEARLE then introduced the subject of sugar making from sorghum, when after a partial discussion, it was, on motion of Governor Beaver, resolved that R. S. Searle be requested to produce at our next meeting a paper upon this topic.

On motion, adjourned to meet at Lewisburg, Pa., December 7 and 8, 1887.

EXTRACTS FROM THE ANNUAL REPORT OF THE SECRETARY.

During the year the amount of the correspondence which claims the attention of the Secretary is quite large; each year an attempt is made to select certain subjects for investigation and report, and so far as practicable the correspondence of the office is directed towards these topics. In the following extracts an attempt has been made to give the result of the information gleaned from this correspondence; the limited space at our command prevents our giving more than a brief synopsis of each topic, and much that is of value in the correspondence is, for the same reason, necessarily excluded.

It is not to be understood from this that the following extracts cover the correspondence of the Board during the year; letters are received upon all imaginable topics relating to agriculture, horticulture and their kindred topics, and in all cases answers have been returned conveying such information as was at the disposal of the Secretary. The following is intended merely as an outline of some of the more important topics embraced in this correspondence.

RETROSPECTIVE.*

This, being practically the close of the tenth year of the existence of our Board, would seem to be an appropriate time for a retrospective glance at its history, and for a resume of the leading events of its work.

On the 24th of January, 1876, a bill, entitled "An act to establish a State Board of Agriculture," was introduced into the House of Representatives. After the usual reference to the committee on Agriculture, it was amended and reported back to the House with an affirmative recommendation. After discussion it was finally passed with but twenty-two negative votes. Passing over to the Senate, the action of the House was confirmed with but one negative vote, and by the signature of Governor John F. Hartranft, affixed May 8, 1876, it became a law.

In accordance with the concluding section of the law, Governor Hartranft summoned the members elect to meet in the State Library, February 1, 1877, for the purpose of "transacting such business as should come before them." At this meeting the following were present:

Ex-officio members—Hon. John F. Hartranft, Governor; Hon. J. Simpson Africa, representing the Department of Internal Affairs; Dr. J. P. Wickersham, Superintendent of Public Instruction; Hon. J. E. Temple, Auditor General; Dr. James Calder, President of the State College.

Members appointed by the Governor—Dr. John P. Edge, Col. James Young and John F. George.

Members elected by County Agricultural Societies—Berks, W. G.

*Read at annual meeting of 1887.

Moore; Blair, Hon. Thaddeus Banks; Centre, John Hamilton; Chester, Thomas J. Edge; Crawford, Hon. M. C. Beebe; Indiana, George W. Hood; Lancaster, Henry M. Engle; Montgomery, W. H. Holstein and W. A. Yeakle; Mercer, Andrew Robinson; Northumberland, John A. McFarland; Schuylkill, J. S. Keller; Union, J. W. Shriner; York, Dr. W. S. Roland.

Messrs. Edge, Beebe, Africa, Roland, Calder, George and Hamilton were appointed a committee to prepare by-laws, and so well was their work done, that, with but little exception, the same by-laws govern the Board at the present time.

The second meeting of the Board was held May 22, 1877, and at it the following additional members presented credentials—Adams, E. G. Fahnestock; Bradford, L. J. Culver; Bucks, Eastburn Reeder; Juniata, David Wilson; Lehigh, J. P. Barnes; Northampton, C. L. Whitesell; Lycoming, D. H. Foresman; Luzerne, J. B. Smith; Susquehanna, J. C. Morris.

The counties of Bucks, Chester, Lancaster, Lehigh, Lycoming, Luzerne, Juniata, Schuylkill and York, still retain the same representatives, and of the members appointed by the Governor, we still have Dr. Edge and Col. Young

At this second meeting the positions of Botanist, Pomologist, Chemist, Mineralogist, Entomologist, Veterinary Surgeon and Microscopist were created and filled, and of those thus appointed all but two still retain the same relation to the Board.

At this meeting the Secretary presented his first report, which, among other things, contained a draft of the present fertilizer law, which was slightly amended and passed by the Legislature at a later period.

The annual report of 1877 was a model of mechanical workmanship and was one of the finest ever issued by the Board. In it the subject of the manufacture of oleomargarine was first agitated in this State and the report there presented has been quoted in all of the noted battles against this foe of the dairyman.

During the year 1878 the counties of Cumberland, Columbia, Tioga, Franklin, Warren, Beaver, Greene and Somerset, each sent members elect with proper credentials. During this year the celebrated Guenon Commission was appointed by Governor Hartranft, and its report has probably done more to make the work of the Board known that any other single act. During this year the skeleton of what was afterwards made a corps of crop and live stock reporters was formed, and estimates obtained of the cost of the several kinds of live stock and of the leading crops. The annual report of this year contained two hundred and eighty-six pages and was more in demand than any other report.

In 1879 the membership of the Board was still further increased by additions from the counties of Butler, Clinton. Erie, Lawrence and Wayne.

At the annual meeting of this year the Secretary presented the subject of the appointment of standing committees and they were appointed by the Board. During this year the celebrated fertilizer law went into effect, as did also the act for the suppression of contagious pleuro-pneumonia, both of which originated from the Board.

In addition to the annual meeting, others were held during the year, at Philadelphia and Mercer, and a large amount of valuable matter gathered into an annual report of two hundred and seventy-two pages.

In 1880 members were admitted from the counties of Dauphin and Montour. At the annual meeting of this year, Hon. D. H. Foresman announced the death of Prof. F. A. Allen, member from Tioga, and appropriate resolutions were presented and adopted. During the year meetings were held at Gettysburg and Reading, and numerous practical essays read and discussed; the work of the year was given in an annual report of two hundred and ninety-six pages. During this year the question of the right of more than one agricutural society in a county to elect members of the Board, was raised, discussed and settled. The question of a State industrial museum was first agitated and a committee to consider the subject appointed. The reports of the honorary officers were the leading feature in the annual report of this year.

In 1881 the counties of Armstrong, Jefferson, Sullivan and Washington sent members elect provided with proper certificates of membership. The death of Hon. Thaddeus Banks was announced and appropriate resolutions presented and adopted. During this year the by-laws were slightly amended and a resolution was adopted recommending the establishment of a State Experiment Station. A resolution asking that county agricultural societies be exempted from taxation was referred to the Committee on Legislation. Meetings were held at Williamsport and York, and an annual report of three hundred and eight pages published.

In 1882 Lebanon county claimed the right to a membership in the Board and sent her present representative. During this year a resolution was presented in favor of changing the date of the annual meeting to "the Tuesday following the third Wednesday," but when it was shown that such a change would require a modification of the organic law of the Board, the resolution was withdrawn. The Secretary was directed to prepare and present a form of a certificate of membership in the Board and after proper discussion it was resolved that all credentials must be made out on this form. The standing committees of this year all made excellent reports which constitute a prominent feature in the annual report of four hundred pages. In addition to the annual meeting, others were held at Allentown and Washington. The report of the Committee on Forestry of this year (Dr. W. S. Roland, chairman) has been quoted as the standard of authority for this State in State and National reports. More was this year done in the direction of collecting statistics than during any preceding year.

The year 1883 was not characterized by any additions to the membership of our Board, nor were there any items of special importance in its transactions. During this year the question of dividing the work of the Board by districting the State, was brought to the notice of the Board and a committee appointed to take the matter into consideration. A report was made and four districts proposed, the adoption of the report to be left with the annual meeting; after discussion by sections, the plan was adopted, but before it was carried into execution the plan of holding local or county farmer's institutes was adopted. The certificates of membership were modified so as to include the acts of Assembly bearing upon the membership in the Board. During this year meetings were held at Erie and West Chester and a report of three hundred and eighty-three pages published. Among its leading items was a re-publication of the test of the Guenon system. An ornithologist was added to the list of honorary officers. The Dairy Committee (Eastburn Redeer, chairman,) made a report which has since been quoted as the leading dairy authority of the

State. During this year the plan of requesting the appointment by local farmer's clubs, grangers and county agricultural societies of delegates to represent them at our meetings was adopted and since then has grown to its present popular proportions. The value of this addition is shown by the attendance of delegates, properly accredited, at nearly every meeting since.

In 1884, in addition to the annual meeting, other meetings were held at Lock Haven and Bedford. The Committee on Dairy Products were instructed to prepare and present a draft of an act to prevent the manufacture and sale of oleomargarine in the State, and thus the Board commenced the battle which ended with the prohibition act of 1885. Hon. Leonard Rhone was appointed a member of the Board by the Governor. The question of the State Experimental Farms was brought up, discussed and the Committee upon Legislation directed to examine into the matter and report as to the powers of the Board in reference to these farms. The list of standing committees was revised and some additions made to the number. A report of two hundred and eighty-two pages was published in which the leading features were a complete and extended report on Carp Culture, a full report of the Committee on Dairy Products, in which drafts of three laws in relation to oleomargarine were submitted, report on forestry, and the report of the analyses of a large number of samples of genuine and imitation butter.

In 1885 meetings were held at Harrisburg, Towanda and Lancaster. The death of Hon. M. C. Beebe, member from Venango, was announced and appropriate resolutions adopted. The oleomargarine act was presented to the Legislature and became a law. The appropriation for the necessary expenses of local and county institutes was granted by the Legislature and the first one was held at Titusville, December 22 and 23. The leading features of the report of two hundred and ninety-two pages were: A complete review of the fertilizer question, a report on the curl in the peach by the Botanist, a report on milk by Prof. Cochran, and on the food of birds by Dr. Warren, report on Guernsey cattle, and the discussion of the oleomargarine question.

Wyoming was this year added to the list of counties represented in the Board.

In 1886 the propriety of holding local or county farmer's institutes was tested by institutes held at Titusville, Lock Haven, Honesdale, Oxford, Montrose, Atglen, Mifflintown, Doylestown, Washington, Lewisburg and Bloomsburg. The large attendance at each of these institutes may be accepted as a proof of the appreciation of the farmers of the State of the efforts of the Board in this direction. All were well managed and well attended, but those at Doylestown and Montrose were well attended up to the very close, showing no abatement of interest during the whole time.

Thus from a membership of but thirteen county representatives in 1877, the Board has grown to a county membership of forty-six in 1885, and has probably reached its maximum strength under its present organic law. Instead of a small meeting in the State Library it now holds meetings attended by many hundred, as has been the case at several of the meetings, and organizes institutes attended by a larger number.

Local or County Farmers' Institutes.

Under the provisions of the acts authorizing the holding of local or county farmers' institutes, meetings have been held at Titusville, Lock Haven, Honesdale,Oxford, Montrose.Atglen, Mifflintown, Doylestown, Washington, Lewisburg, Mackeyville and Bloomsburg. All of these were well attended and the interest manifested by the practical farmers of the vicinity and the discussions which followed the reading of essays upon practical topics, fully warrant the expectations which have from time to time been advanced in favor of a limited expenditure of the funds of the Board for this purpose. By the liberality of the Legislature, and as an indorsement of the work the Board has accomplished in this direction, the annual appropriation for the expense of farmers' institutes, has been increased to three thousand dollars per year.

The thirty-second, thirty-third and thirty-fourth quarterly reports have been devoted to the publication of essays and discussions of these institutes, and it is intended that the thirty-fifth and thirty-sixth reports (which have been delayed by the press of work at the State printing office) shall contain similar matter. Enough has accumulated to fully occupy the three hundred pages of two of these reports, and the institutes held during the latter portion of the present year will readily furnish at least one hundred and fifty pages more, making an accumulation of not less than four hundred and fifty pages of printed matter.

In arranging for these meetings, the resident member of the Board, is (in accordance with the instructions of the Board) given the preference; next in order the requests of county agricultural societies have been considered, and lastly the claims of individuals. The increased appropriation now available makes it probably that the Board will be able to grant all requests of this kind, and at the same time, by procuring essayists and speakers from a distance, add greatly to the value and interest of the meetings. Members of the Board and its Secretary attend these institutes and assist in the exercises and discussions which always take place. In addition to a limited number of papers by members of the Board, local essayists and speakers have been called upon for assistance, thus adding very materially to the local interest and attendance; and it is proposed during the remainder of this and the coming year, to secure the active assistance of speakers upon agricultural topics from other States.

So important has this plan of holding meetings become, at which farmers can discuss questions of practical interest to themselves, that Vermont has made the holding of one in each county in the State every year obligatory. Wisconsin has made an annual appropriation of nine thousand dollars for this purpose, and other States have made liberal appropriations for the same purpose.

The Wheat Crop of the World.

Accustomed to the large total yields of our Western States we have fallen into the habit of regarding our own country as the great wheat-producing nation of the world, and to pay but little regard to even the total production of other countries as integers in regulating prices. We have fallen into the habit of supposing that if our yield as a nation is small the price must necessarily advance, and if it is large the price must and will fall. Within the past ten years we have

been somewhat rudely made aware of the fact that there were other forces at work which exercised a powerful influences upon prices and which, year by year, have disappointed all calculations based upon former data; causes and effects which have completely neutralized any influence produced by the yield and acreage of this country. An examination into the wheat production of the other countries of the world shows us that several countries which were formerly purchasers from us, now produce a surplus which competes with ours in the world's markets, and that other countries, from having been very small producers, are rapidly overhauling us in the race.

Some of our most careful staticians have estimated the total wheat crop of the world at 2,000,000,000 bushels, and the total population at 1,000,000,000, thus giving about two bushels to each individual. Of course some countries do not consume nearly this ratio, but upon the other hand others greatly exceed it. Thus, while Africa is far short of consuming her quota, our own country averages at least four and one-half bushels to each inhabitant, and produces, on an average, at least eight bushels to each one.

Taking our average national crop, we may estimate it at 450,000,000 bushels per year, or at the rate of about eight bushels to each individual. If, as before stated, we consume but four and one-half bushels (one barrel of flour) each, we have left for export a ration of about three and one-half bushels per capita.

For seven years, or from 1880 to 1886 inclusive, our crops, their average yield, price per bushel and value per acre, have been as follows:

YEAR.	Area of wheat crop. Acres.	Average yield per acre—Bushels.	Average price per bushel.	Average value of produce per acre.
1880,	37,986,717	13.1	95.1	$12 48
1881,	37,709,020	10.1	119.3	12 03
1882,	37,067,194	13.6	88.2	11 99
1883,	36,455,593	11.6	91.0	10 56
1884,	39,475,885	13.0	65.0	8 38
1885,	34,189,246	10.4	77.1	8 02
1886,	37,000,000	12.4	68.7	8 49

A writer, in alluding to the capabilities of our country when we shall have attained to the average crops of England, uses the following language:

"The average yield per acre in 1886 was not far from twelve bushels, while in Great Britain for the same year it was a trifle under twenty-seven bushels, and in 1885, upwards of thirty-one bushels. Had our wheat acreage been as prolific as that of Great Britain last year, the yield would have exceeded one thousand million bushels, or one half the total product of the world, instead of a little more than one-quarter, as at present. This comparison shows the capabilities of the United States as a wheat growing country, when our farmers shall arrive at the conclusion that it will be more profitable to make two bushels of

wheat grow where only one grew before, than to double the yield by doubling the acreage. Although positive statistics are not at hand to substantiate the assertion, it is probable that the consumption per capita of wheat is as high in the United States as in any countries except France and Great Britain. It has not reached its highest point yet by any means, as in the South and South-west Indian corn forms a much larger proportion of the daily food of the people than it will when the farmers of those sections increase the fertility of their soils and give more attention to wheat growing, as they are certain to do in the future."

Next to our own country in total wheat-producing capacity we have France with about 300,000,000, or at the rate of over eight bushels per capita.

Third on the list we have India with an annual crop of (at present) 250,000,000 bushels and with a consumption so small that it leaves the large bulk of her crop for the markets of Europe, which she can supply at a much less rate per bushel than we have heretofore done.

As the fourth in the list of wheat producers we have Russia with her annual crop of about 225,000,000 bushels, or a production at the rate of two bushels per capita, with a consumption on which we have little means of calculating, but with a knowledge that by far the larger majority of her people derive their sustenance from the 750,000,000 bushels of rye which they annually produce.

Fifth on the list we have Austria and her outlaying States with a yield of 150,000,000 bushels, or in the ratio of about three bushels per capita.

Following in regular order we have Spain with her addition of 130,000,000 from 18,000,000 of people; Italy with 130,000,000, or at the rate of five bushels per capita.

On the other hand, we find Germany producing but 82,000,000 bushels for a population of 45,000,000, or at the rate of but two bushels per capita, where twice that amount is needed for the per capita comsumption. Great Britain, with a population of 35,000,000, produces but 65,000,000 bushels, and is the largest purchaser in the world's market. To supply her needs over and above her production she absorbs the surplus of Australia and India, which she takes first because they can not only be furnished cheapest, but because they are paid for in her own products, and after these have been absorbed makes up her deficiency from our surplus. From this it is evident that our place in her markets, and those of the world is dependent upon the crops of Australia and India, since they must be first sold before ours comes into the market.

A writer upon agricultural statistics thus sums up the production of other and smaller wheat-growing countries:

"Next after England in total product of wheat comes Turkey with 41,143,750 bushels, closely followed by Canada with 37,219,234 bushels. Algiers is credited with 32,915,000, Argentine Republic and Chili with 28,800,629, Roumania with 22,258,146. Little Belgium produced 18,414,688 bushels and old Egypt, the cradle of the wheat-growing industry, and the country from which nearly all our varieties of wheat originated, grew 16,457,500 bushels, or a trifle over three bushels per capita last year. The wheat crop of Egypt is not so great as formerly, for while the Nile valley is just as fertile as when in the days of Joseph it produced by handfuls in the seven plenteous years, much attention has been given of late to the culture of cotton, an industry

stimulated by the cotton blockade of Southern ports during the late war. The cold kingdoms of Sweden and Norway managed to grow 2,468,628 bushels of wheat last year, while rocky, mountainous Switzerland brought up the rear of European wheat-growing countries with 1,645,750 bushels."

The same writer, in alluding to the possibility that the consumption of wheat may be an index to civilization, writes as follows:

"Along with the largest consumption of wheat has usually gone the greatest progress in the arts, sciences and literature, as well as the greatest material comfort to the peoples who preferred and were able to enjoy on the largest scale the luxury of white bread and other grades of food of which it is the recognized type. It does not follow from this that the leading wheat-growing countries are of necessity the most highly civilized, as in some instances, notably in Russia and India, the great wheat crops form the principal article of exportation, the peasants who grow it being obliged to sell it to secure money for taxes and other necessary expenditures, themselves living upon the vegetables and coarse grains which are not marketable. In other countries like England and Germany, where the consumption of wheat reaches a high figure, a goodly amount has to be imported. As a rule, therefore, the consumption of wheat in any given country may be regarded as a better criterion of its wealth and civilization than its production of this staple."

The Value of Carbon in the Soil.

At the Bucks County Institute and at the annual meeting of 1887, the address of Hon. John W. Hickman, developed the fact that there was an apparent difference of opinion between the lecturer and the practical farmers present, as to the real value of carbon and vegetable matter in the soil. Mr. Hickman had advanced the theory that the atmosphere would at all times furnish an abundant supply of carbon for any and all crops; on the other hand a number of practical farmers claimed that the vegetable matter (carbon) in barnyard manure was entitled to a fair valuation; and that it was not just to the barn yard to simply value farm manure for its phosphoric acid, potash and nitrogen. A careful examination of the question will, we think, convince all that this difference is more imaginary than real and that after all there is very little real difference of opinion in relation to the question. Mr. Hickman's address was confined to the use of commercial fertilizers, and he quoted from Ville's Experiments to show that plants and crops on soils entirely devoid of carbon (vegetable matter) and which had been carefully charred to destroy carbonaceous matter, would still produce an abundant crop, rich in carbon and showing no chemical or mechanical difference from similar crops grown upon ordinary soils rich in carbon.

All bulky fertilizers such as barnyard manure, lime and ashes, are entitled to credit for two modes of action: 1st. As a fertilizer entering into the structure of the plant, and 2d. As a mechanical agent opening and loosening the soil.

To illustrate, let us suppose it possible to crop a soil continuously for a given number of years without the addition, either by stubble or roots, of any carbonaceous matter, we may safely assume that a point would sooner or later be reached at which its mechanical texture would become such as would seriously interfere with the yield of the crop. That sooner or later, from the exhaustion and absence of

all vegetable matter, the soil would become hard and compact and would fail to contain within its particles that portion of air which is essential and necessary to the crop; it would also, from the same cause, fail to retain the rainfall, or having received it would fail to retain it for a sufficient length of time to supply the necessary moisture to the growing crop.

It must also be remembered that Mr. Hickman's claim that increasing crops might be produced by the use of commercial fertilizers alone, included the annual turning under of the roots and stubble left by the crop, and he distinctly stated that he would include one or two crops of clover in his rotation, and thus obtain a large amount of carbon.

When the question is reduced to one of a mere source of carbon for manurial purposes and for supplying the actual needs of the plant, we have no doubt that the atmosphere is by far the most economical, and that as a simple fertilizer, barnyard manure is not entitled to a value for its carbonaceous matter, but in the line of incontrovertable facts we think that for the *mechanical* value of this carbon, it *is entitled to a valuation.*

Aside from its actual and direct manurial value, and its mechanical effect and value, carbonaceous matter is also entitled to a credit for its indirect effect in the production of nitrogenous compounds. Just what this effect is, may still be a matter of dispute, but it must be admitted that in some way organic matter, either directly or indirectly, is capable of furnishing nitrogen.

A noted writer upon agricultural topics, puts the question in the following shape: "It is well for farmers not to lose sight of the fact that after all the science and experiments connected with tillage, the one great essential element of plant growth is the presence of organic matter. There are many arguments and so much talk which is not argument, in favor of the chemical elements of plant growth, that there is danger of the old ways being forgotten and old laws being ignored. There are some soils filled with organic matter, and they will stand the drain for a long time and show good results. No man can live forever on medicine, and this the charitable way of putting it. It is not so harsh as to say 'stimulants.'"

Professor William McMurtrie of the University of Illinois, writes as follows:

"It is well known that all vegetable material in the soil, whether turned under in the process of green manuring or as the debris of former crops, or even as stable and barnyard manure, quickly enters into decay. That in this decay, the result of a species of fermentation, those little known compounds, termed in general *humus*, *humic acids*, are formed. These are the primary results of decay or fermentation. Carried to ultimate result carbonic acid, ammonia and free nitrogen, with corresponding quantities of water, are liberated, the mineral constituents of the ash are set free, and these latter feed succeeding crops. But Dr. Bolton, I think it was, showed that these humic acids have an important influence in the chemical disintegration of the mineral constituents of the soil. The feldspars and the phosphatic minerals are broken down and decomposed by them to an extent that would be impossible by other agents ordinarily met in the soil.

"But Grandeau has also shown, and all who have had to do with the analysis of rich black soils have recognized, that in presence of these matters almost nothing in the soil is soluble in water. And it is gen-

erally recognized that all plant food must be so soluble. Grandeau found further that the black material could be acted upon by a ten per cent solution of ammonium carbonate, or free ammonia, and dissolved, forming a dark-brown liquid. Upon analysis of the material so dissolved he found that it contained all the elements necessary to the life and growth of the plants. This experience of Grandeau with the celebrated black soils of Russia we have repeated in the black soils of the prairies of Illinois and Texas.

"It therefore appears that at an intermediate stage of the decay of vegetable or carbonaceous material in the soil it is capable of decomposing refractory mineral compounds, and yet at the same time fixing the important elements of these compounds in combinations insoluble in the soil waters and thus preventing their loss in leaching by drainage. Then as the humus compounds are further decomposed by the minute organisms of decay, these mineral elements are liberated at a time when they are most needed by plants, and often about as fast as they can be used. They therefore serve both as a medium for the preparation of plant food and as a regulator of the supply to the plant. And it seems to me that this constitutes the most important function of carbon in the soil."

Following the teachings of Ville, Lawes and others, we are strongly impressed with the theory which runs through all of their writings and which conveys to the reader the idea that there is in either, the soil or atmosphere, an ability to furnish an unknown amount of nitrogen to the growing crop, and all of our evidence points to the belief that this supply is in some way connected with the supply of organic, or vegetable matter in the soil, and that soils rich in vegetable matter, either have the power of forming nitrogen from this kind of material, or that by virtue of containing this matter, have an increased power of absorbing or obtaining nitrogen from the atmosphere.

Admitting thls we are compelled to assume that organic matter is entitled to three different scources of credit, viz: for actual plant food (aside from carbon) furnished, for a valuable mechanical effect, and for a result produced at least by its presence in the soil, upon other matters of a chemical character, which by its action are materially modified and rendered valuable as plant food.

The Theory of Deep-setting for Cream.

At the request of a member of the Board an attempt was made during the past season to secure reliable data as to the comparative effects of deep and shallow-setting for butter. After much correspondence we can but return to the point at which we started, and which, in previous reports, has been stated before, viz: That either plan, when all the requisites are carried out, will give very nearly all the butter in the milk, and that either, without carrying out the proper requisites, will waste more or less of the butter; that the increase in the amount of cream (so-called) obtained by deep-setting is deceptive, and that the increase in bulk is due to two causes, neither of which will, in any way, increase the amount of butter: 1st. The milk by deep-setting has much less surface exposed to the air, and the resulting cream therefore contains a greater percentage of water than that which is raised by shallow-setting. 2d. That in ascending through the deeper column of milk the particles of fat (cream) take up a larger percentage of casein of cheesey matter, and their volume is thus increased over that of the cream raised from the same amount of milk

by shallow-setting; that the real comparison between the two methods is more one of labor and quality than of quantity and amount; that in proportion to the amount of milk set, the deep cans will require less labor in keeping them clean, and that, other things being equal, the butter from deep-set milk is superior to that from shallow-setting. To sum up, we quote the following from John I. Carter, a celebrated Chester county dairyman, who has experimented with all of the newer methods. Mr. Carter writes as follows:

"*First.* That the simplest, and, perhaps, all things considered, the safest plan to set milk to raise cream, is in shallow pans, in a good stream of cool, living water. The flow of water is a splendid disinfectant or absorbent of smells and air impurities, such as unavoidably belong about large dairies. And hence, entire cleanliness is more easily secured in spring houses with good strong springs. But the *advantages* of spring houses may be easily overbalanced if the springs are not convenient or cool enough. A well-built spring house for shallow pan-setting must have three times the capacity or size of a house or room wherein the deep-setting plan is employed, and the shallow pans will cost twice as much as the deep ones holding an equal amount of milk.

"*Second.* We demonstrated, to our entire satisfaction, that deep cans in a low temperature, say 45° or 49°, would raise cream yielding butter, equal in amount and of superior quality (if in very hot weather) with shallow pans in a higher temperature—60° or over.

"*Third.* We also demonstrated that the greater the depth or bulk of milk the lower the required temperature, and that twenty inches was about the maximum height of can and nine inches the maximum diameter. Perhaps less high and diameter would be better.

"*Fourth.* We also found that in very low temperatures less time was required for the cream to raise. With pans at 60° it took thirty-six hours. With twenty-inch pans, at 45° to 49°, it took twenty-four hours, and at still lower temperatures from twelve to fifteen hours. Of course, the low temperature had to be secured with the aid of ice.

"*Fifth.* We also proved, to our entire satisfaction, that it was no advantage to arearate sound milk or to expose it to the atmosphere to carry off animal odors, but that equally good and long-keeping butter could be made by sealing up the fresh milk and keeping it at low temperatures. We have tested various inventions for cooling milk, some using an air medium cooled with ice, some with water, and some with both air and water."

The theory of deep setting is best explained by the following from Henry Stewart, of Bergen county, New Jersey:

"It may seem unreasonable, but it is true, that a mass of water at thirty-three degrees will be liquid, while at one degree less it will be solid; and equally it is true that a churning of cream may be a mass of foam which fills the churn, and will not change in hours of labor, at sixty degrees, when the addition of a quart of hot water, sufficient only to raise the temperature two degrees, will break the cream and bring the butter in five minutes. So temperature may be, and is, of wonderfully great importance in this business of butter-making, and one must learn to recognize this fact and govern himself accordingly; for churning is a chemical as well as a mechanical operation. The cream must be in a certain stage of what is called ripeness—let us say at once decomposition—that is the true term to use, for as ripeness in fruit is merely a change of the elements of the fruit which is the

beginning of decomposition, so the necessary acidity of the cream is a process of decomposition also, and this must go precisely so far, and no farther, to produce perfect butter. And temperature has a very important influence upon this process of decomposition. A deep can of milk set in a spring pool, which is closely covered and which remains steadily at forty-two degrees, has remained perfectly sweet, with the cream upon it, for fourteen days in my milk house, at any time this winter. In my milk cellar, at a temperature of sixty degrees, the milk sours in six days; at sixty-two degrees it will sour in five days; at sixty-five degrees in three days. A can of cream kept at fifty-five degrees remains sweet for a week, and when placed in a temperature of sixty-five degrees for twelve hours becomes then only perceptibly sour; in six hours more the sourness is very apparent to the taste and scent, and it is then in what I consider the best condition for churning. When cream so prepared is put into the churn at fifty-five degrees no butter comes after three hours churning; it remains thick, and the churn revolves (I use the revolving rectangular churn, but it is precisely the same in the Blanchard, which I sometimes use for comparison) without any sound, and goes very hard, that is, with cream enough for twenty-five pounds of butter in it. The addition of four quarts of hot water (temperature one hundred and eighty degrees), which is enough to raise the cream to about sixty-three degrees, makes an immediate change, and the cream breaks and butter comes in a few minutes. But of course the quality is ruined. When cream, also prepared in precisely the same way, is warmed to sixty degrees, the butter comes in one hour, and sometimes a little over, but never less; when it is warmed to sisty-two degrees the butter comes in thirty minutes, invariably, or in eight to fifteen minutes at sixty-five degrees; but not unless the cream has stood for eighteen hours, or even twenty-four, at sixty-five degrees. This all refers to experiments made during the past few weeks. The result of this testing by the thermometer and experimenting, is that the cream may be raised either in deep cans set, as under the Cooley and other plans, in cold water at forty-two degrees, or in shallow pans in a dairy room at sixty degrees, and kept so cold as to be sweet six days after milking; then warmed up for eighteen hours to sixty-five degrees, and may then be churned, with certainty that it will make butter in from eight minutes at sixty-five degrees, to thirty minutes at sixty-two degrees, and sixty or eighty minutes at sixty degrees. The quality of the butter is the best when the cream goes into the churn at sixty-two degrees. Now this shows that temperature and chemistry have a good deal to do with churning, for heat is a true chemical agent.

"But mechanical influences also effect churning, for I find there must be a certain amount of agitation in the churn. When the churn is revolved eighty times a minute, the above periods are required to bring the butter; with only sixty turns a minute, a proportionately longer time is necessary. The principal difficulty, however, with my correspondents is in fixing the right temperature, and in the means of procuring it safely. And there is some risk in warming a quantity of thick cream, so that the heat may be diffused evenly. One person puts the cream jars in hot water, and the sour milk curdles and fills the butter with pieces of curd. This is caused by the over-heating of the cream in contact with the sides of the jar while the remainder is not affected. To warm the cream thoroughly, safely and conveniently,

I would suggest the following plan for those who have not a dairy completely furnished with all the modern improvements.

"I would make or procure a box of common boards, such as dry-goods packing case, twenty-two inches deep and no larger than is required. This I would line with rosin roofing paper, which is air-proof, has no scent and is quite thick, tacking it closely around the boards. I would cover the outside and the lid also with the paper, doubled, and then put on an outer case of boards, so as to have it non-conducting. The floor needs no covering. I would put the cream into this box the day before it is to be churned, and with it a can or pail, covered, filled with boiling water and then close the box. The heat will be slowly diffused through the cream until it is raised to sixty-five degrees. The cream is then kept at that temperature, no less, and no harm will be done if it should go even to seventy degrees. It should be stirred a few times and tested with the thermometer. At night the cream may be left in the box, and it will fall to sixty-two degrees by the next morning. The temperature of the churn should be raised also to sixty-two degrees by putting hot water in it and giving a few turns, and the cream then churned. The butter will come of a very convenient consistence for the first working, and I don't think there will be any trouble then with the cream foaming, or the butter not coming; or coming of an oily or greasy consistence, or of a rancid odor, as some of my correspondents complain; these last faults being clearly due to the churning at too high a temperature."

Bovine Digestion.

Essays which have appeared in former numbers of our reports, have aroused quite an interest in the problem of animal digestion and the duties devolving upon the stomachs of the bovine tribe; the correspondence of the Board during the past year, clearly shows that our stock-feeders are anxious for practical information upon the actual values of different kinds of stock-food. This inquiry has no doubt been also stimulated by articles relative to the comparative feeding values of straw or fodder and cornmeal as compared with good hay, which have recently appeared in the agricultural press of this and other States.

Before anything definite can be decided as to the comparative digestibility of the different classes of food, it is essential that we more thoroughly understand the respective functions of each of the four stomachs of our cattle; without this understanding all feeding problems are of doubtful solution, and even with the best knowledge attainable we are compelled to admit that their solution will vary with each individual animal upon which they are tried; as in the human race, different animals have a varied power of digesting the same substances; thus one animal will be found to do best (to gain the most nourishment) with a certain kind of food; some can, by an excellent digestion, utilize straw and other rough fodder in connection with cornmeal, oil cake or other concentrated food; others, with a less powerful digestion, are unable to utilize such food, and hence, we arrive at the conclusion that all which we can expect is the laying down of general rules which are adapted to the average animal, and which cannot be universally adopted as feeding axioms.

Experiments instituted a number of years ago by the writer, and since followed up by observation and the result of the experiments of others, enable us to arrive at the following conclusions as to the duties of each of the four so-called bovine stomachs:

1. That the first stomach or paunch is simply a reservoir in which the partially masticated food is kept in reserve for a time when it can be more thoroughly masticated and incorporated with the saliva; that coarse food, such as grass, fodder, hay and straw, all goes into the paunch where it is softened, and afterwards, by a spasmodic action of the gullet, thrown into the mouth for remastication; when swallowed the second time it does not again find entrance into the first stomach, but, by muscles under the control of the animal, the opening is closed and the finely masticated food goes on into the third stomach or "maniplies." If properly masticated cornmeal, bran, oil cake, &c., does not go into the paunch but is carried on over the third into the fourth or true digestive stomach, and hence we infer that all the advantage (for which some claim so much) gained by mixing meal or bran with the cut hay, is that it is then carried into the paunch in stead of into the fourth stomach.

2. That the main duty of the second stomach or "honeycomb" is to act as a reservoir for all the surplus water which is not needed in the rumen or paunch; that at the will of the animal this store of water can be drawn upon to moisten the food on its way from the rumen or paunch to the third stomach or maniplies, and if this is already moist enough, no water is furnished from the second stomach.

3. That the duty of the third stomach or maniplies is to still further mix and incorporate the food by their peculiar squeezing action; our experiments also seemed to indicate that if the food was in too moist a condition when it entered the maniplies, the surplus moisture was taken out of it, and by some species of muscular action not clearly defined, taken into the honeycomb or second stomach.

4. That the fourth stomach is the only one in which true digestion takes place, and that, except in the case of the coarser kinds of food, the other stomachs (so-called) seem to play little or no part. If whole corn is fed and is not taken into the rumen or paunch a considerable portion of it will escape the digestive powers of the fourth stomach and therefore be lost to the feeder, but that when this corn, by passing through the rumen, is softened and submitted to salivary action a second time, very little, if any, is undigested.

5. That animals of different ages have different digestive powers and that a class of food which is acted upon by certain stomachs in the full-grown animal, is not acted upon in the same way or by the same organs in the young and growing animal. Thus, for instance, in the young calf the first three stomachs are not used and lie dormant, awaiting an age when by a change in the kind of food consumed they will be called into use. Thus a small calf by nibbling at hay or grass soon brings his rumen into action and with it the third stomach, and, sooner or later, depending upon his diet, all come into play and perform their duties in the digestive economy.

6. That from the causes we have assigned, or from some other equally potent influences, a given amount of hay and meal will produce more and richer milk if *moistened* and fed together than if fed at separate times, and that there is somehow more advantage in mixing and moistening for a full-grown animal than for a calf, and that if whole grain is fed to a young animal much more of it will find its way into the rumen or paunch than if fed to an older steer, and that different animals of the same age and class will, by passing it undigested, waste very different proportions, some apparently obtaining all that is

valuable in it, and others passing at least fifty per cent. of it apparently undigested.

7. That much of the benefit which has been claimed for steamed food is due to and should be credited to the mixing and moistening of the hay and meal before feeding, and that if an experiment was instituted between meal and cut hay moistened and fed (mixed) without steaming and of the same mixture steamed, much of the benefit claimed for steaming would be lost, and the margin, which in any case appears to be too small to warrant the expense, would become still smaller.

8. When the feeding of pure meal produces scouring it is an evidence of one or both of two things: first, that too much is being fed—more than the digestive organs can assimilate properly, or, second, that the digestive organs of that individual will not bear as much as others which may be in the same stable and consuming the same food. If a young calf scours it is an evidence that its food is (in nearly every case) too rich in fatty matter and too poor in casein, and that the remedy is a diet of at least partially skimmed milk, which if boiled, is all the better and safer.

9. That from an over proportion of meal fed alone, many animals suffer severely from indigestion and that the symptoms of this are those of the so-called "wolf in the tail," which is simply another name for animal indigestion, and should be so treated without the necessity of slitting the end of the tail and binding it up with salt and pepper.

Feeding for Pork.

The increased profit which, during the past two or three years, has fallen to the lot of those who find a market for their surplus grain in the form of pork, taken in connection with the low cost and short time required for getting up a stock, have directed attention to this branch of farm economy. Numerous inquiries relative to the cost per pound of pork and the possible gain per day, have from time to time reached us and have been replied to from the best data in our possession. For the purpose of furnishing such information we find no other better that the recent experiments of Prof. Sanborn of the Missouri State Agricultural College, the results of which have appeared in Bulletin No. 28 of that institution.

Experiment number one had for the purpose of ascertaining the proper amount for a "maintenance ration" and the results of three experiments we have condensed in the following tables:

Feeding for Maintenance.

Period I.—Food, Middlings.

No. fed.	Lots.	Weight, lbs.	Gain, lbs.	Ate.	Days fed.	Per cent. eaten daily.	Gain per day each.	Food eaten for pound gain.
3	1	482	36	275	16	3.57	.75	7.64
3	2	513	66	275	16	3.35	1.39	4.16
3	3	478	47	255	16	3.05	.98	5.42
3	4	528	68	305	16	3.59	1.41	4.48
12	. . . .	*500	54.2	. . . .	16	3.39	1.13	5.42

*Average each 166.6.

Period II.

No. fed.	Lots.	Weight, lbs.	Gain lbs.	Ate.	Days fed.	Per cent. eaten daily.	Gain per day each.	Food eaten for pound gain.
3	1	502	4	277½	28	1.97	.047	69.
3	2	503	5	283	28	2.00	.059	56.6
3	3	540	loss 6	303	28	1.96	loss	
3	4	560	0	320	28	2.04	.000	
		*521	3	. . . .	28	1.99	.0008	

*Average each 173.6.

Period III.

No. fed.	Lots.	Weight, lbs.	Gain lbs.	Ate.	Days fed.	Per cent. eaten daily.	Gain per day each.	Food eaten for pound gain.
3	1	517	26	116	7	3.18	1.23	4.46
3	2	561	20	100	7	2.77	.95	5.00
3	3	544	8	90	7	2.34	.38	11.25
3	4	565	10	72	7	1.82	.47	7.20
		*535.5	16	. . . .	7	2.52	.75	6.98

*Average each 178.5.

In his review of the results as set forth by table III, Professor Sanborn writes as follows:

"This trial was made largely to illustrate the folly of our unpardonable and indefensible practice of keeping hogs for eighteen months to obtain growth that may well be made in seven to eight months. The growth made in the first period would give a shoat weighing in seven months two hundred and forty pounds, including his birthweight. This would be got from feeding, on a basis of two per cent. for maintenance of only three hundred and forty-nine pounds more food than necessary to maintain existence. Now if a shoat is kept fourteen months or twice seven months, the maintenance food at two per cent. daily would be five hundred and four pounds for the extra seven months uselessly fed, or, in other words, maintenance rations are greater than the food of growth, and those of us, which is about all of us, who feed fourteen months, actually throw away more food in unnecessary maintenance than the actual food growth by 44.4 per cent. Regarding this food as middlings at fourteen dollars per ton, we have a value of three dollars and fifty-two cents thus lost in maintenance or for the 3,876,325 hogs of our State, $13,644,640."

The tables as arranged from the tabulated results of a large number of experiments by Professor Sanborn, are as follows:

Growth by Weight—Lots Weighing Under Fifty Pounds.

	Number of animals fed.	Weight of lot.	Whole gain.	Amount eaten.	Days fed for one hog.	Days each lot were fed.	Per cent. live weight eaten daily.	Gain per day.	Pounds food for pounds gain.
	3	143	11.5	42	21	7	4.18	.54	3.65
	2	90	32	131.5	56	28	5.02	.57	4.70
	2	56	31	100	62	31	5.80	.50	3.23
	2	93	45	180	72	36	5.30	.62	4.00
	2	79	56	235	108	54	5.60	.52	4.90
	2	96	48	174	56	28	6.50	.85	3.60
	2	61	41	134	62	31	7.08	.66	3.06
	8	196	93	370	112	14	12.50	.78	4.00
	2	84	5	95.7	56	28	4.00	.80	2.12
	2	100	50	185	88	44	4.20	.57	3.70
	2	37	17	83	62	31	7.25	.27	4.80
	2	53	14	90	72	36	4.70	.19	6.40
	2	71	38	124	62	31	4.00	.60	3.26
	2	60	25	116	62	31	3.70	.41	3.90
	2	61.4	27	185	108	54	5.48	.25	6.89
	2	46	131	379	100	50	7.90	1.31	2.90
	2	98	135	398	100	50	8.10	1.35	2.90
	2	89	118	308	100	50	6.90	1.18	2.60
	2	96	48	174	56	28	4.00	.80	2.12
	2	76.7	64.5	184	62	31	7.75	1.20	2.85
	47	1,652.1	1,025	3,593.2	1,421	665	115.96	13.16	73.49
Averages,	20	35.1	21.9	76.46	30.23	33.25	5.79	.66	3.67

Growth by Weight—Lots Weighing Fifty to One Hundred Pounds.

	Number of animals.	Weight of lot.	Whole gain.	Amount eaten.	Days fed for one hog.	Days each lot were fed.	Per cent. eaten daily to live weight.	Gain per day.	Pounds food for pounds gain.
	3	151	91	334	138	46	4.85	.646	3.67
	3	152	13.5	26	21	7	2.43	.643	1.91
	2	135	58	215	78	39	4.61	.743	3.01
	2	192	56	290	86	43	3.51	.651	5.18
	2	160	90	380	84	42	5.65	1.071	4.22
	2	157	75	250	84	42	3.79	.893	3.33
	2	156	62	281	104	52	3.47	.596	4.53
	2	151	89	215.5	78	39	3.62	1.140	2.42
	2	147	90	259	72	36	4.88	1.250	2.87
	2	110	40	193	72	36	4.87	.555	4.82
	2	167	75	269	84	42	3.83	.893	3.58
	2	178	112	438	106	53	4.64	1.057	3.73
	2	183	108	396	106	53	4.08	1.017	3.67
	2	182	106	417	106	53	4.31	1.000	3.93
	2	184	93	388	106	53	3.98	.877	4.17
	2	103	145	365	100	50	7.08	1.460	2.50
	3	151	79	397	135	45	5.84	.584	5.03
	2	138	63	272	88	44	4.48	.716	4.31
	2	177	117	390	78	39	5.66	1.500	3.33
	2	101	38	210	72	36	5.88	.522	5.25
	43	3,075	1,060.5	5,985.5	1,798	850	91.46	17.82	75.96
Averages,	20	71.5	37.2	139	41.8	42.5	4.57	.89	3.79

Growths by Weight—Lots Weighing One Hundred to One Hundred and Fifty Pounds.

	Number of animals.	Weight in lbs.	Whole gain.	Amount eaten.	Days for one hog fed.	Days each lot were fed.	Per cent. eaten to live weight daily.	Gain per hog per day.	Food for pound of gain.
	4	430	188	808	252	63	3.000	.746	4.30
	2	247	55	187	52	26	2.91	1.059	3.40
	2	227	55	168	28	14	5.28	1.964	3.05
	2	296	162	674	108	54	4.22	1.500	4.16
	4	498	84	552	208	52	2.13	.403	6.57
	2	249	56	339.7	86	43	3.17	1.232	3.20
	2	287	106	416	104	52	2.78	1.019	3.92
	2	250	110	400	84	42	3.81	1.309	3.63
	2	282	93	389	74	37	3.72	1.256	4.18
	2	282	35	178	60	30	2.10	.583	5.08
	2	235	105	355	71	37	4.04	1.419	3.38
	2	233	79	323	64	32	4.29	1.234	4.09
	2	236	78	321	64	32	4.24	1.218	4.11
	2	257	100	340	64	32	4.13	1.562	3.40
	2	225	87	286	64	32	3.97	1.359	3.29
	4	491	134	762	208	52	2.98	.644	5.69
	2	202	65	360	104	52	3.42	.625	5.54
	2	228	47	200	42	14	6.27	1.679	4.25
	2	267	100	427	86	43	3.72	1.163	4.27
	4	590	188	594	156	39	2.58	1.205	3.16
	48	6,240	1,966	8,579	1,998	793	79.03	24.45	87.84
Avearges,	20	124.8	39.3	171 6	39.9	37.7	3.76	1.16	4.18

Growths by Weight—Lots Weighing One Hundred and Fifty to Two Hundred Pounds.

	Number of animals.	Weight of lot.	Gain.	Amount eaten.	Days for one hog.	Days for whole lot.	Percent. eaten to live weight daily.	Gain per day.	Pounds food for pound gain.
	3	513	66	275	48	16	3.55	1.375	4.166
	3	478	47	255	48	16	3.34	.979	5.425
	3	528	68	305	48	16	3.61	1.417	4.485
	2	326	90	242	60	30	2.47	1.500	2.690
	4	742	184	1,185	124	31	5.16	1.484	6.440
	4	760	320	1,207	124	31	5.13	2.580	3.771
	2	375	70	385	106	53	1.94	.660	5.500
	2	358	46	230	52	26	2.47	.884	5.000
	2	325	40	164	28	14	3.60	1.429	4.100
	2	362	85	300	60	30	2.76	1.417	3.571
	4	775	268	1,253	124	31	5.21	2.160	5.052
	2	347	60	289	52	26	3.23	1.154	4.817
	2	352	85	300	60	30	2.83	1.417	3.529
	2	372	133	470	98	49	2.57	1.357	3.534
	2	325	115	489	98	49	3.07	1.173	4.252
	2	321	98	425	98	49	2.85	1.000	4.337
	41	7,259	1,775	7,961.5	1,224	397	53.44	21.80	70.66
Averages,	16	177	43.29	194.1	29.85	24.9	3.34	1.36	4.37

Prof. Sanborn also condenses into the following tables the results of his experiments as to the comparative feeding value of cornmeal and middlings:

Table No. 11. Middlings.

Groups according to foods fed.

	No. of animals.	Weight of lot.	Gain.	Amount eaten.	Days for one hog.	Days for whole lot.	Per cent. eaten to live weight.	Gain per day.	Pounds food for pounds gain.
	4	430	188	808	252	63	3.00	.75	4.30
	3	151	81	334	138	46	4.85	.646	3.97
	3	513	66	275	48	16	3.35	1.37	4.16
	3	478	47	255	48	16	3.34	.98	5.42
	3	528	68	305	48	16	3.61	1.42	4.48
	3	143	11.5	42	21	7	4.18	.54	3.65
	3	152	13.5	26	21	7	2.43	.64	1.91
	2	90	32	131.5	56	28	5.02	.57	4.70
	2	135	58	215	78	39	4.61	.74	3.01
	2	102	56	290	86	43	3.51	.65	5.18
	2	247	55	187	52	26	2.91	1.06	3.40
	2	326	90	242	60	30	2.47	1.50	2.68
	2	56	31	100	62	31	5.80	.50	3.23
	2	93	45	180	72	36	5.30	.62	4.00
	2	160	90	380	84	42	5.65	1.07	4.22
	2	157	75	250	84	42	3.79	.89	3.33
	2	227	55	168	28	14	5.28	1.96	3.05
Total,	42	4,078	1,072	4,388	1,238	502	66.63	14.40	62.01
Averages,	17	97.09	25.5	104.2	29.4	29.5	3.92	.847	3.65

Table No. 12. Cornmeal.

	Hogs.	Weight.	Gain pounds.	Ate pounds.	Days.	Per cent.	Gain per day.	Food for pound gain.
	4	491	134	762	52	2.98	.64	5.7
	4	775	268	1,253	31	5.2	2.16	5.5
	4	1,031	245	1,329	30	4.3	2.0	5.5
	4	1,293	125	614	17	2.8	1.7	4.9
	3	151	79	397	45	5.8	.58	5.02
	2	79	56	235	54	5.6	.52	4.9
	2	138	63	272	44	4.4	.71	4.3
	2	558	133	660	52	2.2	1.27	5.0
	2	202	65.4	360	52	3.4	.63	5.5
	2	96	48	174	28	6.5	.85	3.6
	2	177	117	390	39	5.6	1.5	3.3
	2	267	100	427	43	3.7	1.16	4.2
	2	347	60	289	26	3.2	1.15	4.8
	2	414	75	285	30	2.3	1.25	3.8
	2	228	47	200	14	6.0	1.68	4.25
	4	596	188	594	39	2.5	1.20	3.0
	2	228	47	200	14	6.27	1.68	4.2
	2	61	41	134	31	7.8	.66	3.6
	2	101	38	210	36	5.88	.52	5.25
	2	321	98	425	49	2.7	1.00	4.3
	2	412	80	349	29	2.9	1.35	4.3
	2	477	75	318	29	2.3	1.29	4.2
	2	440	90	389	29	3.0	1.55	4.3
	2	352	85	300	30	2.8	1.42	3.5
	59	9,229	2,358	10,566	843	100.13	27.47	111.47
Averages,	24	156.4	39.6	179.0	35.1	4.16	1.14	4.64

A series of careful experiments at the Wisconsin University under the care of Professor Henry have enabled him to arrive at the following conclusions as to the effect of feeding large amounts of cornmeal and other feed rich in carbohydrates:

1. That there is an excessive development of fat not only on the outside of the muscles and beneath the skin, but also among the muscles.
2. That the muscles of the body fail to develop to their normal size, especially some of the most important ones, as those along the back.
3. That an abnormally small amount of hair and a thin skin is the result.
4. That while the brain, heart and lungs do not seem to change in weight, the spleen, liver and kidneys are unusually large.
5. That the amount of blood in the body is greatly reduced from the normal.
6. That the strength of the bones may be reduced one-half.

Such results are but the natural effect of the kind of food used and the manner of feeding. A failure to properly develop the muscles may be the result of a want of the proper amount of exercise as much as the character of the food. Pigs running in an open field, though fed entirely upon corn and food rich in carbohydrates, will in all probability develop a proper amount of muscle. When penned up without much exercise and fed heavily it is but natural that the organs which carry off the waste, as the spleen, liver and kidneys, will be developed to a degree which will in some measure correspond to the extra labor demanded of them.

The Germ Theory.

A careful microscopic examination of the blood and secretions of animals which have died from the effects of any contagious disease shows the presence in large numbers of certain peculiar living germs or organisma. It is further proven by the same mode that each disease is not only represented by these living germs, but that each disease has its own specific germ, a germ which is peculiar to itself and which is not found in the secretions of animals suffering with any other disease. From this fact springs the theory that all diseases are due to the presence in the system in unusual quantities of certain germs, and that in fact the disease will not exist without the presence of its peculiar germ.

The general acceptance of this theory explains many outbreaks of contagious and infectious disease which have long been a puzzle to veterinary practitioners; many dark points are explained by it and the clue given to the prevention and cure of disease. From the acceptance of this theory we have all our results in vaccination, inoculation, &c., as shown by the celebrated French scientist Pastuer, and without the acceptance of this theory we are compelled to regard all of his results as visionary and erroneous.

To these germs the general name of *bacteria* has for the sake of distinction been given, and their examination has been the life-long work of a number of scientists, who, like Pastuer, have slowly worked out results from very limited and indefinite data. The opposition to the theory arises mainly among those who, admitting the presence of the bacteria, yet claim that they are *the result* and not the cause of the disease; that is, in other words, they follow and not precede the disease; that the disease must first exist and then they will be found.

Prof. H. Garman, who has given the question much attention, thus explains the fundamental points of the theory:

"Suppose a farmer selects from a litter of pigs two lots of three each as nearly alike as possible, treats them exactly alike as to food and shelter, but with a clean, sharp needle punctures the fore-leg of the members of one lot. A comparison of the two lots at the end of a determined period would probably show little difference between them. This is inoculation, in a coarse way, minus the virus. Now suppose he introduce on the point of a needle into the fore-legs of one of his lots of hogs some well-known chemical, and at the end of a short period all three of this lot show symptoms of swine plague and finally die of this disease. And suppose that he and his neighbors repeated this experiment again and again, and find that in the majority of cases the hogs inoculated in this way die of swine plague, and that those not so treated are exempt. (1) Would not this amount to a demonstration that the chemical substance used produced hog cholera when introduced into the system *by inoculation?* Now let him feed this chemical substance to his hogs, or introduce it into their bodies in other ways, and suppose that in most cases death by hog cholera is the result. Suppose, further, that this substance is always to be found in diseased hogs but never in healthy ones. From this evidence (2) would he not be right in claiming that this substance produced the disease *when taken into the system?* And would he not show practical sense in thereafter carefully excluding it from the quarters in which his hogs were kept? If, now, he found this same chemical in the bodies of the hogs which had taken the disease 'spontaneously' (?) would he not have reason for asserting that this substance was the cause of hog cholera?"

It is often the case that the spread of any contagious disease through a herd is marked with peculiarities which are very difficult to explain. An animal in the last stages of lung plague may be introduced into a herd, and even though present there but a few hours a number of animals may be infected, but not all; in fact, in practice in the very worst outbreaks of lung plague with which we have to deal we find animals which have apparently exhibited no signs of the disease which an ordinary observer may detect. This, however, cannot be accepted as evidence that the germ theory is incorrect, for we have no proof (1) that the germs were taken into the system of that particular animal; and (2) that it did not have the disease in a mild form not detected by the ordinary observer.

It is not safe to trust to the observations of the uninitiated when contagious diseases are being dealt with. The writer has condemned and killed animals suffering with contagious pleuro-pneumonia (lung plague) which the owner stoutly asserted had nothing the matter with them. In many such cases the post-mortem revealed lungs weighing thirty or forty pounds, and to the initiated giving all the sounds incident to the disease.

It may be claimed that one division of these bacteria, to which those causing lung plague probably belong, cannot be present in the system without creating the disease in its worst form; but there is another class, of which the bacteris causing tuberculosis (tubercular consumption), may be taken as a type, which may be and are often present in the blood and secretions without, for the time being, creating any dangerous symptoms or producing any real disease; thus the bacteria of tuberculosis may, and undoubtedly does exist, and lay ap-

parently dormant in the systems of animals in infected herds and for a considerable time show no effects, but as soon as by a heavy cold, the proper conditions exist for its rapid propagation in the lungs, the disease is exhibited in its most virulent form. It has been claimed that ordinary tuberculosis as we find it among animals, may be caused by exposure and a violation of the laws of ventilation; but the evidence seems to prove that at some time previous to the animal having been brought under these influences the germs were introduced into its system, and having been introduced there remained dormant until the violations of the laws of health produced that condition which caused the rapid propagation of the bacteria belonging to tuberculosis.

Bad ventilation, exposure to cold winds and rain, over-heating, drinking cold water when very warm, do not therefore produce tuberculosis, for they cannot create the germs of the disease, but these germs, being already in the system, are by the peculiar combination of circumstances, given the opportunity for which they have been waiting, and the disease follows. The violation of nature's laws did not cause it; they simply furnished the fuel, the system already containing the lighted match already for its mission of mischief.

Another class of germs, as seem only to be capable of producing their peculiar disease when they obtain access to certain organs, and to produce it to very different degrees according to the distance of the their introduction from the peculiar organ in which the disease is manifested. Thus, innoculation for contagious pleuro-pneumonia produces a slight form of the disease, which does not reach the contagious point in the animal innoculated, but gives the animal immunity from the disease if taken through the lungs, and in the manner in which the contagion is carried naturally; the same matter, if introduced directly into the lungs, would have probably caused the disease in a more virulent form, and possibly have produced death.

It is almost certain that the germs of many diseases may be taken into the digestive organs, if they are perfectly healthy, with impunity; thus, it is very possible that the germs which cause tuberculosis may pass through the digestive organs of a healthy animal and no effect be noticed. It is true that the risk of the germs getting into the circulation through the assimilated food, has to be taken into consideration, but practical acquaintance with this disease shows us that animals pasturing day after day with infected animals who are constantly throwing off the germs of the disease, must take into their systems numbers of these germs, and yet such animals when exposed to any cause producing disturbance in the lungs, will suddenly exhibit the worst symptoms of the disease. Our experience leads us to assert that an apparently healthy cow may be selected from a herd infected with tuberculosis and submitted to the best judges, who, upon examination may be unable to find any signs of the disease; she may then be carefully housed and cared for; guarded against everything which is supposed to introduce a condition favorable to the propagation of the disease germs, and yet when she calves the chances are over ninety in the hundred that she will immediately develop a rapid form of tuberculosis. The strain on the system produces exactly the condition favorable to the propagation of the germs, and the result naturally follows.

Anothe peculiar class of germs are those which produce our Texan, Spleenic, or Spanish fever, so often met with in this State from the

middle of August to the middle of September. Southern cattle which have been exposed to the miasmatic influences which cause the development of the disease germ, are themselves granted immunity from its effects but during their passage through northern latitudes leave behind them in their urine, droppings and exhalations from their bodies, the germs which will produce the disease in any northern animals which may come in contact with anything which can convey these germs left by the southern animals. Thus far there is nothing about the disease which renders it subject to any other than the general rules which govern all diseases, but here a difference is noted; in the native or northern animal these germs multiply so rapidly as to cause death, while in the southern animal they produced no visible effect; from the bodies of the southern cattle these germs carry death to every northern animal who may be so unfortunate as to get them into his system. No doubt our northern animal, while suffering from the disease, throws these germs off from his system, but they have strangely lost all power of infection and of growth and multiplication; the northern animal cannot infect another animal; the germ has lost its vitality by the passage through his system.

In connection with this class of germ disease, we find that innoculation or an attack of the disease grants immunity from another attack for a period of time which seems to vary with the disease; thus an animal purposely innoculated for contagious pleuro-pneumonia may be brought into contact with a badly diseased animal with impunity; that this immunity from the disease exists for a series of years seems to have been proved; the same effect follows an attack of the disease in its natural form; it gives immunity from subsequent attacks. If then, says the doubter, the germ theory is correct why does this state of affairs exist; why, if the germs of any special disease are introduced into the system of the innoculated animal, does the disease not exhibit itself as before? To this those who have given the subject the greatest amount of investigation and thought answer, that these germs only can exist in the system by the absorption of a certain class of food found therein. By innoculation or by an attack of the disease from which the animal has recovered, the supply of this necessary food is exhausted and it requires a series of years for its accumulation. It being assumed that the germs, even if introduced into the system, cannot live or be increased without the necessary material upon which to live.

It has been claimed that in all outbreaks of contagious disease among live stock the weak and puny suffer first, and that the least loss is among the strong and healthy individuals of the herd. The experience of the writer with all contagious diseases of live stock will not bear this theory out. It is true that there is a larger percentage of loss among the weak and puny members of the head but this is not due to the fact that they alone are attacked. All have about the same chances of taking the germs into their system, but the strong and healthy have by far the greater chance of throwing off the disease by the reaction which nature always offers immediately after the attack. A strong and healthy animal will come through all right while a weaker one would have died under an attack only half as severe. In outbreaks of contagious pleuro-pneumonia we invarably find it the rule that young and thrifty animals in good condition suffer most and are oftenest attacked, and that if there are any young animals not milk-

ing in the dairy, they will be not only the first attacked but among them we will experience our greatest percentage of loss.

In our outbreaks of verminous bronchitis (Husk or hoose) the loss is usually among the weaker animals in the herd, the larger members often showing very little of the effects of the disease; not because the strongoli (microscopic worms) which caused the trouble did not find access into their lungs and bronchial tubes, but because the animal possessed sufficient strength to throw them off by the spasmodic coughing which ensues; the strong animal having a much greater chance to relieve itself than the weak and delicate one.

If the germ of any disease is once lodged in the system, nature at once asserts her power to overcome the difficulty and with the strong and robust animal the chances are greatly in her favor, while with the weak the reverse is the case.

The acceptance of the germ theory of disease carries with it the enforced belief that all remedies must be directed towards the prevention of the multiplication of the germs which cause that disease and the destruction of those which are already formed. All investigations in veterinary science must therefore be directed to medicines which shall have the general power of destroying certain germs; like quinine in malarial disease, the medicine must be able to meet with and destroy the bacteria special to the disease. It therefore follows that if we meet with a disease which, like contagious pleuro-pneumonia and spleenic fever, which cannot be controlled by any medicine yet tried, we are forced to the conclusion that this special bacteria possesses a vitality which surpasses all others.

We know that it does not require a very low temperature to destroy the germs of Texan or spleenic fever, that of frost being sufficient, but as we cannot make use of this knowledge to attack the disease in the system of the animal, it is of no avail. We also know that the specific germ of hog cholera will fail to propogate itself at a still lower temperature, but for a like reason this knowledge is of no avail as a practical remedy.

Sources of Nitrogen.

At a recent meeting of the Board, Dr. E. L. Sturtevant startled some of its members by the assertion that "there was not a particle of proof to show that plants ever absorbed, directly, a single ounce of nitrogen from the atmosphere." This blow at the theory that plants derived by far the greater part of their nitrogen from atmospheric sources, has caused no little correspondence and questioning on the part of those who are not yet prepared to accept it.

The burden of scientific evidence is certainly upon the side of Dr. Sturtevant, and Professor R. C. Kedzie, of the Michigan Agricultural College, writes as follows:

"I have said that the plant is incapable of directly appropriating free or atmospheric nitrogen, and this is strictly true. If we plant a seed in a soil deprived of all nitrogen by burning the soil, and water it only with distilled water free from ammonia, the plant will make only a small growth, limited by the amount of nitrogen the seed contained; and the plant itself will contain no more nitrogen than did the seed from which it grew. But if certain classes of plants such as the clovers, peas, beans, vetches, turnips, etc., find a sufficient amount of available nitrogen to secure a vigorous start in growth, they will accumulate a large amount of nitrogen from the air, and store this up

for succeeding crops It is possible that these plants are liable to lay hold of free nitrogen in this way in consequence of the ozone they give off during active growth, since it is well known that ozone will bring free nitrogen into chemical combination and form nitric acid in presence of watery vapor.

"While all plants are capable of drawing a certain amount of required nitrogen from the air, they differ greatly in this respect; one class, characterized by broad leaves and abundant foliage, are capable of drawing almost the whole of their nitrogen from the air and leaving a surplus in their remains for the wants of succeeding crops; while another class, which have narrow leaves and small amount of foliage, are incapable of obtaining a sufficient supply of nitrogen from the air for full development. This distinction is forcibly expressed by Villa of France, who divides plants into nitrogen producers and nitrogen consumers. Red clover may be taken as the type of the nitrogen producers and wheat of the nitrogen consumers. The one is broad-leaved, has abundance of foliage, and can arrive at a high degree of development without the use of nitrogenous manures; the other is strap-leaved, has little foliage and cannot reach a satisfactory development without a supply of nitrogen beyond what the air can afford; it demands an accumulated supply of nitrogen in the soil. The pressing demand of all cereal crops is an adequate supply of available nitrogen in the soil. This may be furnished by barnyard manure, by nitrates, salts of ammonia, guano, etc., or it may be furnished by growing crops which have a special power of accumulating nitrogen from the air, burying these in whole or in part in the soil and thus storing up in the soil an amount of available nitrogen for the use of future crops. The power of one crop thus to store up materials for growth of future crops is a fact that lies at the foundation of successful agriculture."

At the recent meeting of the Board at Bellefonte, in a paper on "Recent Investigations on the Nitrogen of Soils and Plants," Professor William Frear of the State College, used the following argument and reasoning:

"The chief controversy has centered about the question of the assimilation by plants of atmospheric nitrogen, excluding that present in the form of ammonia and nitrous and nitric acid; concerning the assimilation of which by leaves or not, there has been no dispute. Priestly was early led to the belief that plants do assimilate free atmospheric nitrogen; De Soussure, twenty years later, after most elaborate investigation, arrived at the opposite conclusion. Boussingault, in 1837–8, made experiments which led him to adopt Priestly's conclusion. Ville, in 1849–52, made experiments which pointed in the same direction; but in 1851–5 Boussingault conducted experiments from which he found that plants receiving air containing nitrogen only in a free state did not live, while others, exposed under exactly the same conditions but receiving nitrogen in a combined form, grew vigorously. Finally, Dr. Pugh, the first president of what is now the Pennsylvania State College, associated himself with Sir John Lawes and Dr. Gilbert at Rothamstead, England, for the purpose of submitting the question to experiment under such conditions that all points in dispute might be tested. After most careful and elaborate experiments upon both cereals and leguminous plants, these distinguished scientists announced as the result of their investigations that free nitrogen is not assimilated by plants.

"As a result of these investigations the large majority of agricultural chemists and plant physiologists accepted it as an established fact that the vegetable growth of the world must depend for its nitrogen upon the amount already present in the soil, in addition to the relatively small amount absorbed by the soil as ammonia, from the atmosphere or brought down as ammonia and nitrous and nitric acids in the dew, rain and snow. It was admitted that there is a considerable difference between the food habits of cereals and of clover or legumes, but the ability of the latter to grow consecutively on the same soil for years without the aid from artificial supplies of nitrogen, and their failure in most instances to respond to the application of nitrogenous manures, was regarded as preëminently due to a difference in root habit and not to any power in the latter to assimilate free nitrogen. It was known that the insoluble nitrogenous constituents of the soil are not assimilable in any considerable measure by the cereals, but it was thought possible that the legumes, including the clovers, might be able to attack and assimilate these insoluble compounds which always form the larger proportion of the nitrogenous matter of soils. Nor was it overlooked that there are drains upon nitrogen contained in the part of the crops removed and not returned as manure to the soil. Especially prominent was the loss by the subsoil drainage, in consequence of which our rivers annually pour immense quantities of valuable constituents into the sea. Upon striking a careful balance the adherents of this school must admit that *under agricultural conditions* the loss is greater than the gain; or, in other words, that we are living upon the nitrogen supplied and stored up during previous ages and that this reserve is being surely and steadily exhausted wherever the most careful farming is practiced."

In a recent number of *Agricultural Science*, Dr. Manley Miles, writes as follows:

"The researches of Schlœsing and Muntz (1887–8) and the conclusive verification of their results by Warrington at Rothamstead, proving that nitrification is caused by an organized ferment, has given a new interest to the study of the nitrification of soils, and manures, as we now have a satisfactory explanation of much that had before been involved in obscurity.

"As a factor in the complex processes of plant nutrition, and in the widely discussed question as to the origin of the available supplies of nitrogen to vegetation, the microbes, which are now generally admitted to be the active agents in the process of nitrification, need to be carefully studied, their life history traced, and the conditions which have an influence on their vital activities definitely determined.

"In the widening of this prolific field of research, the chemical and physical constitution of soils can now be profitably investigated in greater detail, with the aid of all the modern improved methods which the progress of science may render available, not only with reference to the tracing of the involved chemical reactions which are taking place, but to give the required data for making a rational estimate of the biological conditions which are essential to the well-being and vital activities of the minute organisms concerned in the metabolism of soils and manures in their relations to the nutrition of plants.

"The practical importance of the microbes of nitrification has repeatedly been recognized since the discovery of their specific *role* in the economy of nature, but as yet but little has been done in the investigation of their habits and life history.

"Dr. Masters has ventured the prediction that the farmer of the future 'may be able to apply to the soil the ferment producing germs needed to change its quality and render it available for plant food,' as the gardener sows the '*spawn*' in his mushroom beds, or the brewer uses yeast to secure the desired process of fermentation.

"In referring to the probable results of a knowledge of the true theory of nitrification, Prof. Storer says: 'Not only will farmers soon learn to make composts and to apply manure in a more rational manner than was possible before, but they will take pains to foster and protect the ferment germs and to sow them as it were, and cultivate them in fit places.'

"In my studies of the microbes of nitrification for several months past, in the intervals of other work, several points of interest have presented themselves which can only be reported in general terms as suggesting lines of further research that may be profitably followed, from the fact that the experiments are still in progress, and definite conclusions in regard to the results of modifying influences in the cultivation of the organisms cannot therefore be made.

"The method of investigation adopted is that of pure cultures in a variety of nutritive media, both liquid and solid, in test tubes plugged with sterilized cotton, and also in the case of liquid media in Steanberg's sealed culture bulbs. The microscopic study of the microbes, in the series of cultures has been checked by frequent qualitative chemical tests to determine the activity of the organisms in their specific *role*.

"One of the most noticeable peculiarities of the liquid cultures already made is the clearness of the culture media in which the microbes of nitrification are grown, which is in striking contrast to the opalescent or clouded cultures of *B. termo*, *B. subtilis* and other allied forms in the same media. A macroscopic examination is not therefore sufficient to determine the success or failure of an inoculation, as is the case with the latter species, and the microscope must be used to trace the progress of the development of the germs with which the liquid is seeded.

"In all of the cultures repeated tests for nitrous acid were made, but it was rarely present, and when it was detected it was in cultures which gave no nitric acid reaction and in which micrococci were found in considerable numbers, together with the peculiar microbes of nitrification, but whether the nitrous acid was produced by the micrococci (as seemed probably from their uniform presence when it was found, and their absence when it was not present), or, by a modified action of the true nitric acid microbe was not determined; and it is a question even as to whether the micrococci are a distinct species or a stage in the development of the true microbe of nitrification."

As leguminous plants are favored in their growth by the nitrates elaborated for them by microbes, so on the other hand it appears to be a legitimate inference that the microbes may in their turn be benefited by the roots of leguminous species near which they find the most suitable conditions for their growth and development, while they are at a disadvantage in the vicinity of the roots of other plants.

In the same essay from which we have already quoted, Prof. Frear writes as follows:

"There has been some discussion upon the character of the organisms producing this fermentation, and some have urged that the oxi-

dizing effect may be due to a number of similar species, but the majority attribute it to the action of a single special ferment, which has been isolated. This ferment placed in appropriate liquids, increased at first slowly, and afterwards rapidly. Upon sowing the proper nutritive solutions with ordinary soil there is first obtained a transformation of the nitrogenous matter into ammonia, unless the nitrogen is already present in that form. Ladureau is inclined to attribute their transformation to the action of the special ferment. After the formation of ammonia has begun, nitrates are formed as the first oxidation products, possibly, as Warrington is inclined to believe, through the activity of another special ferment, and finally the nitric fermentation proper sets in. Schlossing and Muntz found that exposure to a temperaure of 212° F. for ten minutes killed the organism, and that 195° was highly detrimental; on the other hand, its activity was slight below fifty-four degrees, and most vigorous at about eighty degrees. That, therefore, nitrification practically ceases during winter. Dessication of a soil almost entirely stopped the action of the ferment. Free access of oxygen was essential for its oxidizing action; when it is shut off from the soil the process going on in the latter is greatly changed in character. As would be readily imagined from this circumstance, the depth from which a soil sample is taken, exerts an important influence on the activity of the ferment contained. Warrington stated recently that the ferment is always found at the depth of two feet, but less frequently, and in much less vigorous condition, until a depth of six feet was reached. The subsoil nitrogen proved to be readily nitrifiable when freely exposed to the air."

Forests and Rainfall.

After the organization of the State Board of Agriculture, in 1877, the question of forestry and the effect of forests upon rainfall was one of the first to receive the attention of its Secretary, and in its report for that year will be found fifty pages of printed matter and diagrams, giving all that could then be urged upon the question involved. Since then the Board of Agriculture, by its standing committee on Forests and Forestry, and by the annual report of its Secretary, has nearly every year called the attention of farmers and the Legislature to the importance of the subject. These reports embrace all that can be given as reliable, and, while they discard much that is mere theory, carry with them the main points of interest to the student of climatology.

The examinations of subsequent years add very little to our stock of knowledge upon the topic, and the subject when reviewed goes back extensively to the same authorities then cited, and to the same points then argued. All recent data, from whatever source obtained, merely confirms what we have urged in these annual and quarterly reports.

At different times since our report of 1877, drafts of proposed laws, intended to affect and promote the interest of forestry, have been introduced into the legislature; some of these were of such a nature as not to receive legislative endorsement, and others became laws after various modifications. Those which were enacted are either inoperative or thus far without advantageous effect, and the result of ten years of legislation only increases the belief which we expressed ten years ago, viz: That a law or plan which fails to show a pecuniary

profit to the owners of forest and rough land, will eventually fail to affect its desired purpose. We may prove beyond all doubt that an increase of our forest area is for the benefit of the State and the nation, but until we can prove that re-forestration of large areas of rough or mountain land is to the individual interest of the land owner, we will fail to accomplish the desired result. If we can once convince the owners of this class of land, much of which has already been denuded of its timber, that the second growth, if allowed to grow, will give them a good interest upon the investment, we will have accomplished much more than ever can be done by legislation; so long as we fail to show that such investments are or will be profitable, we may offer bounties and exempt timber lands from taxation in vain; if it will not pay as an investment, the exemption from the small amount of tax will not make it profitable; if it will not pay to recover these old timber areas with trees of natural growth, the fact that we may present the owner with suitable trees will not induce them to plant and care for them. There must be a fair margin for a profit above interest upon capital, or the attempt will end in failure.

We then must squarely meet the question of "Will it pay?" for after all that is and will be the test of the enterprise. Many who are in a position to be thoroughly acquainted with the facts of the case assert that it will pay; among these we know of no better authority than Thomas Meehan, the Botanist of our Board, who writes as follows:

"Long ago, I showed that we could expect little from individual effort. We may show a young man of thirty that a plantation of twenty-five or thirty acres would be immensely profitable when he reached sixty. It would be a nice laying up of money for old age; or a capital life insurance for his family, in case of an earlier death. But few men care to deliberately lock up ground for a century or half a century. In a new country like ours, changing conditions make it probable that, before that time, land may be worth much more than the forest, long before the forest has reached market value. The minds of few men are proof against these considerations.

"The remedy is in coöperative associations. A stock company should be formed, large enough to secure tracts of sufficient size to employ a force to look after the trees properly. The stock would always be worth more than its added interest, because the trees are nearing their market value. If one wanted money before the trees were mature, the stock would find a ready market. Of course there would be details in the carrying out of such a project that would require good judgment. The land to be secured might be in locations that would be improving, so that after the century of timber, there would be money in the ground also. This would give value to the stock as time rolled along. The trees best adapted to the location would also require good judgment, and there are many other similar matters of detail, but which an expert in forestry management could work out for such a company."

Assuming the correctness (without admitting it) of the argument that the expense of planting the young trees and keeping the weeds down for several years, will so increase the cost of the investment as to make it unprofitable, we still have the plan of re-forestration by allowing the natural growth to recover the ground. In the advocacy of this plan, we are invariably met with the statement that a forest fire will in a few hour destroy the growth and labor of several years,

and that the forest fires are chargeable with the destruction of a very large proportion of the young timber which is annually allowed to start after the removal of the older growth. A little practical examination will clearly prove that this young growth is burned over and destroyed, not from any inherent weakness of its own, but simply because the limbs, brush and all the debris of the former crop of timber is left on the ground to carry the fire over the tract and to increase its heat to a point which will destroy the young growth. Where all of this debris has been taken off or carefully burned off, we have no trouble from forest fires. The young growth will not, of itself, furnish enough of leaves and twigs to support the flame, or if it does, the heat will not be sufficient to kill the young trees. This we think will eventually prove to be the true solution of the much-vexed timber question, and which will, if anything does, lead to the replenishing of forests in our State. Arbor Day will, of course, have its effect, but that can only be shown to a very limited extent, and will always be more as an element of beauty than as an adjunct to our timber supply or a regulator of climate and rainfall.

If we are correct in this reasoning, it then remains to see how far we can, by legislative enactment, encourage the owners of the proper kinds of land, to permit them to grow up with natural timber. Attempts in this direction have thus far been confined to three modes: First, by encouraging the planting of trees along our public roads by exempting the owner from a certain portion of taxes; second, by offering those willing to test the matter, trees grown at the expense of the State, free of charge, and third, exemption of the land planted or allowed to grow up with natural growth from all or a portion of the taxes now levied upon it. Of these the first is practically inoperative and for the good of public travel it is best that it should be so. The second did not meet with legislative approbation, and the third is yet untried, with a grave doubt as to the constitutionality of the plan. None of these plans have yet met with any *practical* response from the land owner whose interest they were intended to affect; hence they may, except the last, be considered as inoperative and ineffective, and we are compelled to adopt some other plan. This will be the duty of the commission which the Governor has been authorized to appoint, and the result of their labor will be looked for with great interest by those who have made this branch of political economy a partial study.

To the theory of the effect of forests upon rainfall and climate, we have very little to add to what was written ten years ago; we then wrote as follows (annual report of 1877, page 63):

"Passing to the consideration of the effect of forests upon streams, and, by reverse reasoning, to the effect of the destruction of our forests upon streams, we naturally consult the authorities of older countries, and also of the older classes of our citizens. No one will deny that our rivers and larger streams, where the result is most readily noted, are lower in summer and higher in winter than formerly, or that they are more liable to disastrous and sudden freshets than they were fifty years ago; the rafting season on the Susquehanna and its tributaries is shorter and less reliable than formerly, and for this reason our annual supply of lumber is irregular and precarious. The fact being admitted, and we do not think it will be denied, we next look for a cause, and naturally infer that it is due to some irregularity in the source of supply. If, as the Governor has claimed, and as is

proven beyond a doubt, 'the regions where this timber is found are the natural reservoirs from which our streams and rivers are fed,' then we may properly look there for the changes which have brought about these results.

"The volume of the rivers depend upon water supplied by springs, which, in turn, can only obtain their supply from rain-water absorbed by the soil, and passing by percolation into the channels which lead to them. In the forest the porous soil, often covered with a heavy coat of leaves, acts as a sponge by absorbing and holding at least a portion of the rainfall, and by a slow action either returning it to the air by evaporation from the leaf surface of the trees or by percolation to the springs in the lower ground. This effect of timber areas does not necessarily imply an increased rainfall, but merely a more economic use and distribution of the annual amount. As soon as the timber is removed, the character of the soil undergoes a change—becomes less porous and more compact, absorbs less of the rainfall by percolation, and allows more to escape by surface flow, or, in other words, lets it all go directly into the streams, instead of, by retarding its motion, allowing it to escape gradually, thus causing sudden floods, which must necessarily be followed, sooner or later, by low stages of water. During the winter, the result, though accomplished in a different manner, is the same: The forest, not only by radiation, but also by direct shelter from the sun, holds the snow so that the water only reaches the streams gradually, while that from the unsheltered land flows off rapidly and produces the effect noted. Assuming our argument to be correct, that our rafting season is shorter and more precarious than formerly, and that this is due to the cause which we have assigned, it naturally follows that as we continue to destroy our timber the difficulty will be augmented until it will soon reach a point which will very seriously affect a very important interest of our State."

In 1884 the writer (see report of Secretary of the Board, Annual Report of 1884, page 40) gave the following as the result of the investigations of that year:

"It is quite common to hear our older and middle-aged neighbors assert, with considerable force and seeming certainty, that our present annual rainfall is not so great as when they were boys. That streams, which were known to them as boys, are now nearly or quite dried up. That certain noted springs have failed very much in volume or have disappeared entirely. That well-known water powers have been seriously decreased or have been abandoned as nearly useless or of little value. All of these and other similar reasons are advanced to prove that, owing to the destruction of our forests, our annual rainfall has diminished.

"And yet, in spite of these facts (for they are facts), the writer fails, after no small amount of effort, extending over much of the time which has elapsed since the formation of our Board, to obtain any reliable data to prove that there has been any material decrease in our annual rainfall. It is true that we are more liable to periods of drouth than formerly, but, up on the other hand, we find that these periods have been counter-balanced by others of increased or more than usual rainfall; so that our records seem to prove that our average supply of rain is about the same as it was forty or fifty years ago, or as far back as our records extend.

"Admitting these facts, as they are presented by those who claim that there has been a change in our annual supply of rain, we must

explain or account for them upon some other hypothesis. Our correspondence and observation lead us to think that they can be much more satisfactorily accounted for on the theory of an unequal distribution of the same amount of rainfall, and that the same causes which have produced this unequal distribution will continue to exert their influence until (unless prevented by a change in our present system of forest destruction) our seasons will be divided into two portions, which may be termed wet and dry, and which will take rank as such in the same manner as similar changes have been noted in other countries.

"Exactly how this change in the distribution of our rainfall is produced, or how it is to be remedied, is by no means so clear or so easily explained. We however think it is safe to assume that quite as much water passes down our streams, or ravines which were once streams, as formerly, and that if we could devise some plan by which we could retain the rainfall and guard against evaporation, so as to supply the surplus to the streams in continuous and regular amounts, our decreased springs and weakened water powers would become as effective as at any former time, and that the whole problem of our water supply would be solved.

"In past years our forests, by their shade and porous, open soil, accomplished this purpose, and, by retaining the surplus, gave it out by sundry springs to the streams in a regular and not too rapid supplies. In former years our forests, by their shade, prevented a too rapid evaporation from the surface, and thus prevented another present draft upon the source of supply. Formerly the forests, by the shade and shelter afforded by their trunks, retained the snow for a much longer period than now. Formerly the soil of the forest was always moist and open, permitting of the rapid absorption of the rain; now this same soil is generally hard and dry, and, instead of absorbing the water, permits it to rush off into the streams in torrents.

"Formerly our woodlands had no 'washes' and 'gullies,' where they now exist as a hindrance and an eyesore.

"As a natural consequence of this combination of circumstances and causes, we now find that the rafting season on the Susquehanna and its tributaries is not only much more uncertain than formerly, but that it is practically reduced to a period scarcely sufficient to convey the timber to tide-water, when formerly it extended over a period of several months. The water which annually passes down the river is probably as great as it was at any period of which we have a record, but its distribution is much more irregular and uncertain in the amount and continuation of its flow.

"The reports of our Committee on Forest and Forestry, and the correspondence of the Board, clearly demonstrate that the people of our State are alive to the importance of the problem and of the magnitude of the threatened evil. The annual messages of our two preceding Governors, and the well-known interest of our present executive officer, prove that all which is now needed is the proposition of some practical remedy; this once proposed and its practicability demonstrated the remedy may be applied; but it is just here, in the most important place, that we are weak. Thus far no practical plan has been offered; of theory we have plenty and to spare, but, as His Excellency Governor Hartranft once told you, 'No one offers anything practical' for our adoption.

"As a first and primary step let our Legislature, at its next session,

authorize the Governor to appoint a commission, of not less than five, whose duty it shall be to carefully investigate the whole matter, ascertain what other States and other countries have done; let them, by personal examination and by correspondence, ascertain the views and wants of the people in a matter of so much importance to their general welfare, and let this commission present a carefully digested report to the Governor and to the Legislature, and thus furnish us with some reliable information on which to build the structure. This commission should receive no remuneration beyond the actual and necessary expenses, and these should be limited to a reasonable amount, in the expenditure of which they should be held strictly accountable."

A writer in *Forest and Stream* also gives a similar theory, as follows:

"As regards the influence of forests on rainfall. The primary sources are oceans, seas and lakes, from the surface of which water is being constantly evaporated by the sun's rays—the annual measure of evaporation is estimated to vary from two or three feet in high latitudes to eight or ten feet in the tropics. This vapor, borne along by ocean currents in their prescribed courses, is in part precipitated as rain on the ocean, in part borne landward, where the extent, locality and direction of the mountain chains, are mainly instrumental in determining the distribution of the rainfall over the land. Islands of no great area, and free from high mountain chains, are uniformly well watered, but even on islands having a high mountain chain, the eastern slopes of the mountain are invariably visited with a more liberal rainfall than the western; this is because the eastern currents, sweeping up from the tropics, pass through a region of greater evaporation than the western currents, which sweep down from the north.

"The influence of vegetation in contributing to the rainfall needs only a little explanation to render it apparent. Taking first the forest belt of the coast ranges; these are covered in winter with snow to a depth equal to from one to two feet of water, and in consequence of the spongy character of the mass constituting the forest floor—a mass made up of the decomposing leaves, branches and trunks of untold generations of past trees—the melting snow, instead of being immediately carried away by the streams to the river, sinks gently into the floor, and in part slowly percolates away to the streams which it maintains in perennial flow; the other portion is being constantly pumped up by the tree roots, and evaporated from their foliage, with precisely the same effect as if evaporated from the ocean, the spring and summer showers inborne by the sea serving to maintain the spongy floor in a greater or less degree of saturation all through the summer. Whenever the slightest breeze is borne inland, and the greater heat of the interior basin tends of itself to create a breeze inland, there is a constant inward flow of vapor which in time condenses as rain. Within the basin, we have first the evaporation from the whole river system, which alone covers a considerable area, and wherever the banks of the river or other low lands, with the subsoil water at easy depth, are clothed with forest, the trees by means of their roots pump up the subsoil water, and appreciably—if the area of such forest is considerable—enlarge the surface of continuous evaporation, with a proportionate increase of rain; finally, the whole vegetation of the central region, even although its roots do not penetrate to the subsoil waters, pumps up the water from the soil and subsoil, evaporates, and receives it afresh as rain or dew in continuous succession. From this it will

be seen that the fertility of the great central zone of this continent may be due, in small measure only, to the moisture inborne by oceanic current, and that by no means the least important source of its fertility is the economy exercised by its vegetation in maintaining a constant circulation of the moisture proper to the region, and preventing its being drained off by the rivers as it falls. It will hence be readily inferred that an existing vegetation can maintain itself in vigorous growth, with an amount of extraneous aid, in the matter of rain supply, that would be unequal to the origination of a new vegetation, if the old were cleared away."

To summarize we then have the following:

1. That there is no proof that there has been any material diminution of the average *annual* rainfall during the past 40 or 50 years.

2. That the effect produced by the removal of our forest has been upon the distribution of the rainfall and not upon its actual amount or volume.

3. That the restoration of our forest area to its former proportions would cause our rainfalls to be more regularly distributed over the whole area.

4. That in effect forests regulate the supply which is given through the springs and smaller streams to the rivers.

5. That any attempt at re-forestration, to be permanent and to a degree successful, must be accompanied with the item of profit to the individual land owner.

6. That the planting of trees along the public roads is not desirable when the cost of keeping the roads in repair is taken into consideration.

7. That exemption from all of the tax now levied upon such lands will not be sufficient to induce and remunerate the owner for simply permitting the growth of the natural timber and take the chances of losses by forest fires.

8. That until we adopt some plan of preventing forest fires, by the removal of their cause, we need not hope to see any large attempts at re-forestry successful.

9. That we have thus far no practical assistance from the State in the direction of encouragement for forest planting.

At the Bellefonte meeting of the Board, in alluding to the effect of taxation upon the growth of forests, Major Keller spoke as follows:

"I venture one thought upon the subject of Forestry, and in a certain sense it is connected with the essay, also which has just closed. I was very much impressed with what Professor Buckhout said with reference to the necessity of encouraging forestry; and this thought particularly struck me, that since it takes so long to grow a forest, what more pressing need is there than for us to preserve as far as possible the forests that we still have? As connected with the essay which has just been read, I would ask those present who call to mind the great failure of crops in this county in 1886, whether the fields, which laid immediately under the shade and shadow of general woods and forests, did not yield much better crops of grain than those exposed and bare? Whether they did or not, the value of forests, in the light of views presented by Professor Buckhout, must be apparent to every one. If I could induce you to carry away this one thought, which might perhaps take root and produce practical effect, I feel I should have done some little service,—that is, let us avoid as much as possible a further destruction of our forests, by not having them taxed out of

existence. It may not have occurred to many of you present that the wholesale destruction of much of our forest timber the past few years has been occasioned by the fact that owners could not afford to keep them by reason of the excessive taxes imposed upon them. Has it occurred to you that the forest lands are assessed so nearly the value of farm lands that in twenty years a man will have paid for them in taxes? Consequently the man who owns forest lands, if he is taxed for them on the true market value, the same as the man who owns a productive farm is taxed, (what it will bring in the market), you are simply forcing that man to slaughter his timber in order to realize something out of it.

"Now the true rule, it seems to me, is this: The forest property is non-producing property, and the other is not. Farm your land, and at the end of the year it is worth as much as at the beginning of the year; and you have secured a certain amount of income from it. But the forest tract is worth perhaps a very small trifle more at the end of the year than it was at the beginning; but you have had no income whatever from it.

"I have in mind instances where owners of valuable timber tracts have been simply forced to put a saw-mill and the axe to them, because they could not afford to keep them and pay the taxes.

"Now it occurs to me that perhaps if this body will bear this fact in mind, you will soon see what is the proper remedy for this. I have not considered this matter exhaustively; but it seems to me if a law were framed, it should be uniform all over the State; and that there should be borne in mind the importance of a lessened tax on forest lands by reason of the great public benefit which they are to the communities in which they are located; and that they should be assessed upon a different rate than what income producing property is."

REPORTS OF HONORARY OFFICERS.

REPORT OF THE BOTANIST.

By THOMAS MEEHAN, *Botanist of the Board, Germantown, Pa.*

The work of the botanist the past year has been mainly in connection with correspondence from parties in search of information.

The subject of weeds and their eradication is a fruitful theme. Those which spread from underground or creeping root stalks are always more or less troublesome, as it often seems that the more they are cut by the hoe or mangled by the cultivator, the more they spread. Specimens of the couch grass, so call from the wiry roots when washed and dried being used in some parts of the world as a stuffing for mattresses or couches, have been received from several parties who complain of its great persistence in spite of efforts to destroy it. It is closely allied to wheat, *Triticum sativum;* and is known as *Triticum caninum.* It is sometimes known as twitch grass and witch grass, both being corruptions of the original couch grass. One correspondent claims that it is generally known in his locality as devil grass, a name likely to be given to any weed that persistently endeavors to take care of itself. It can only be repeated that no weed need be a

serious trouble to the cultivator of the soil if efforts be made to cut away the young leaves before they mature. All plants store up food in their roots and stems through the agency of their fully developed leaves. Without food a plant can no more live than an animal. Prevented from storing food they must surely die. One correspondent narrates that he followed the suggestions in regard to cutting out this couch grass, and that he seems to have had only his labor for his pains. This only shows that he left his enemy until the leaves were mature enough to prepare some food from the atmosphere. It is often not easy, in the pressure of spring work, to attack weeds as early as it ought to be done. In this case it is better to do a little and to do it well, and leave some portion of the infested ground for another season. A corn crop is the best to give a chance to clear out those troublesome intruders, and after an early and thorough harrowing a boy is often sufficient to follow, in a few days, and cut away or dig with a knife the few straggling green blades that may start up, and which will, if suffered to mature a few green leaves, make all the earlier work of little account.

Of the newer weeds of recent introduction, the red chickweed is the only one that has been brought to the botanist's attention as spreading. The specimens are from Eastern Pennsylvania, where it is said to be so abundant as to be gathered in large quanities by the collectors for large drug dealers. These never know, when asked, for what purposes their employers use the herbs. It has some reputation in European pharmacy in epilepsy and dropsy. It is, however, by no means a troublesome weed. Its common name in the old world is pimpernel, or poor man's weather glass. It closes sometime before rain. Botanically it is *Anagallis arvensis*, and has no relationship to chickweed, but to the primrose family, though the habit is much the same as a chickweed studded with bright red flowers would have.

More than usual attention is being given to the subject of hybridization in improving the races of fruits and flowers. It was long the belief that hybrids are sterile. This belief comes from the well-known fact that the product of the horse and the ass—the mule—is generally sterile. It is proper to say generally sterile, because there have been known cases of progeny between the female mules and the horse. But numerous experiments showed that this common case is rather an exception than the rule, and the truth is that hybrids in general are as fertile as other plants or animals. Since this has been demonstrated, renewed attention has been given to the subject. Mr. Carman, the proprietor of the *Rural New Yorker*, has raised fertile hybrids between wheat and rye, and between raspberries and blackberries, and there seems to be a wide field for experiments in the production of new grains and fruits. No one can tell beforehand what will cross successfully; it is a matter for experiment. There must be some relationship, but it is found that quite close relationship will have nothing to do with each other, while remote relationship will often unite and give good hybrids. In experimenting, it is very important that the flower should certainly have no use of its own pollen. It is waste of time to go on without this absolute certainty. To wait a year, or perhaps several, and then find the female parent plant reproduced exactly, through having accidently received its own pollen, is exasperating. In the closed flower, the anthers seldom burst and expose the pollen powder, but they usually do just before or just after opening.

It is therefore wise to open the flower artificially some hours before it would do it naturally, and cut away the anthers before they mature with the point of a scissors. The stigma is usually not in receptive condition till some hours after the pollen matures. But the pollen desired for the male parent can be applied at once on the cutting away of the anthers. It will remain there till the pistil needs it, and, in this way, prevent other pollen from interfering with the views of the operator.

The subject of the cross-fertilization of flowers, and, indeed, the whole subject of the fertilization of flowers, continues a subject of profound interest with scientific men. It is not so many years since the whole subject was a mystery. True, it has been known for many centuries that the date, the fig and other fruits required the flowers of one tree to exert some influence on the productiveness of another; but the exact process is a victory by modern science. Every intelligent person now knows that the organs in the center of a flower—the pistils—are the parts of the flower connected with the seed-bearing system, and that the organs next surrounding in most flowers are the stamens, the upper portions of which—the anthers—bear the pollen dust that gives life to the work of the pistils. Only by the contact of this pollen with the upper portion of the pistil—the stigma—can seed result. But pollen will not always act. Very often pollen from the same flower is of no account; pollen from some other flower will be active when its own pollen is inert. Mr. Darwin held that foreign pollen is always better than own pollen, and that it is for this reason that so many flowers are arranged that it is only with great difficulty the plant can make use of its own pollen. It is more convenient to get pollen from another flower by means of an insect seeking honey than to make use of its own. This view is undoubtedly true in the main; but it seems to your Botanist to have been pushed too far. In the clover, for instance, it is well known that the first crop seeds but poorly; the second crop is usually relied on for seed. On the theory that insects are so necessary to cross-fertilize the flowers, it has been assumed that the necessary insects are scarce in the early part and abundant in the later part of the clover season; but if one will take the trouble to look at the clover fields, it will be found that bees and butterflies are equally abundant at either search. It will be found further that the humble bee does not enter the mouth of the flower, as it should do to effect fertilization, but slits the side of the flowers and extracts the sweets in that way. Humble bees in like manner slit the sides of all flowers that are tubular or offer any difficulty to a rapid rifling of their treasures by these creatures. Productiveness in plants only follows some check to vegetative vigor. No trees bear fruit until this vegetative vigor is checked. It may be done by some slight injury, such as root pruning or ringing the bark, as well as by age. When this check occurs, the plant is reproductive. It is the check given by mowing off the first crop of clover that makes the second reproductive, and not any action of insects in cross-fertilizing. This seems to be better understood with each recurring year. Much of the trouble with the light crops of fruit following an abundance of flowers, referred a few years ago to matters connected with fertilization of the flowers, are now referred to questions connected with the vegetative and reproductive forces.

Many questions connected with forestry reach your Botanist. Trees are often somewhat nice in their requirements. The failures occasion-

ally reported often come from the soil not being suited to the kind, or from some other conditions being unfavorable to that species of tree. The Larch and the Norway spruce, two very profitable timber trees in the high northern or elevated regions of Europe, have been planted extensively in our flat prairie lands, where the long summer heats are distasteful. When they failed, the trees have been set down as unfavorable to American forestry. Again, some species are more liable to the attacks of insects or of fungus parasites in some localities than others. All these things have been better studied the past year than ever before. As a rule, the various species of oak are less liable to disease or insect attacks than any other, and the white pine among the soft woods is the most generally satisfactory. In planting forests, the trees should not be set very close, or there will be a struggle for food and growth will be slow. On the other hand, if set too wide, the tree will develop strong side branches, and we shall not get the much desired long straight trunk.

The question of the vitality of seed has several times come before your Botanist. Many people note that when a forest is cleared, another kind of tree often proceeds, and people seem to believe that the seeds of the new growth have either been lying in the soil for ages, or that the trees spring up from the ground wholly independent of seed. It cannot be admitted that anything in these latter ages can spring from the earth independently of seed. We can only consider how the seeds get here to introduce the new growth. It can readily be shown that the seeds are not in the ground. Larger seeds, like nuts and acorns, can readily be detected. A few shovelfuls of earth put into a tub of water well stirred up, and then allowed to settle, will have all the vegetable substance deposited on the surface. For smaller seeds, half a jar of clay in water shaken up, will do as well. Your Botanist has never been able to find any seed under such trial. If, however, a piece of wood is examined before the trees are cut down, very often numbers of little trees may be found in a dwarf and half-starved condition, remaining for years but a few inches high, and seeming to the observer to be but part of the ordinary dwarf vestage of the general forest undergrowth. When the forest is cleared off, these little seedlings at once start up into the successional growth. This can be noted by any one who will take the trouble to examine an old forest before the trees are cut down. The larger seeds are brought by crows, and other members of the animal kingdom, in order to be eaten more at leisure, and the smaller seeds are brought there by high winds. It is, however, true that seeds often will live a long time in the earth, or anywhere, where a continuous low temperature is maintained; evidence satisfactory to the author of this report, by his investigations in Alaska, satisfies him that both plants and seeds will exist for many years in a dormant condition under glaciers, growing when the glaciers recede; and many facts are uncontestable, where some flowers and vegetables in gardens continue to appear for perhaps a dozen years after the original plants seeded in the ground.

In sending plants to the botanist for name, they are often sent just as gathered, merely rolling them in paper, or putting them loose in a box. They come rotten, and scarcely distinguishable. They should be pressed dry between thicknesses of paper, and then sent flat between pasteboard covers. It is a pleasure to reply to all inquirers when the material is good, but a sad waste of valuable time to both

the sender and the examiner, when nothing can be made of a reeking waste of decaying weeds.

PHYSICS OF THE ATMOSPHERE.

By Prof. I. THORNTON OSMOND, *State College, Pa., Meteorologist of the Board.*

[An illustrated lecture delivered at the Bellefonte meeting.]

Size—Constitution, Composition, Structure—Pressure—Solar Radiation, Nature, Absorption, Temperature—Movements, General, Cyclones, Tornadoes—Meteors.

Most of you are familiar with discussions of the soil, its constituents, condition, cultivation, etc. It is in the soil that man works in the production of crops. All this toil of his, although a wise Providence makes it a necessary condition of bounteous reaping, is but an infinitesimal part of the work actually expended upon every crop between the germination of the seed and the maturing of the product. The kindly Power who puts forth this great sum of work, operates through his physical agencies, far more in the atmosphere than in the earth. He attends to all this work Himself, and has put none of it in our power to do, so we do not usually think much about it. I propose to talk about this atmospheric field wherein the processes of nature acting by the laws of a beneficent intelligence do a hundred million fold the work for making crops each year that man does with all his industry and pains.

Size.

The height of the atmosphere has not been accurately determined. The great mass of it is near the earth, three-fourths, or more, of it being below the tops of the loftiest mountains, on which the atmospheric pressure is small.

The force of gravity, which decreases as the square of the distance between the centers of the attracting masses increases, and the so-called centrifugal force of a revolving mass, which increases as the square of the velocity divided by the radius of rotation, will be in equilibrium about 25,000 miles from the center of the earth. Hence, at a distance of about 21,000 miles above the earth's surface, particles of air would be thrown off into space, like water from a rapidly moving carriage wheel. There can scarcely be an atmosphere belonging particularly to the earth at or beyond this limit. But this by no means proves that our atmosphere does extend to this height; satisfied that it cannot exceed this, we are to find what part of this space it actually fills, if we can.

Twilight Curve.—Opposite the sun, the conical shadow of the earth is continually thrown on or through the atmosphere. Just after sunset this shadow may be seen rising above the eastern horizon, rising higher as the sun is farther and farther below the western horizon. The boundary of this shadow and the illuminated air is sometimes quite distinct, especially in the tropics where the conditions are most favorable

Let the sun's rays just pass the earth's surface at D (Fig. 1), then DA is the boundary of the shadow. An observer at O sees this ascending his eastern heavens. Knowing his own position, the angular

elevation of A at any moment and the position of D (place of sunsetting) at that moment, he can by simple methods of trigonometry, familiar to every surveyor or high school boy, find the distance AB. The solution makes AB about forty-five miles, after corrections for refraction, etc. Thus it is evident that to a height of about forty-five miles there is an atmosphere sufficiently dense to produce optical effects that affect the sense of vision.

Certain phenomena of lunar eclipses give evidence of an atmosphere capable of a slight refraction of light at a height of sixty-six miles; and the observation of meteorites and auroræ indicate the existence of a very attenuated atmosphere at the height of two or three hundred miles, or even higher.

Possibly, we sometimes lose portions of our atmosphere; we quite certainly pick up gaseous masses, as well as solid, from the spaces through which we are ever flying.

Constitution.

Composition.—Air was considered an element for many ages. It is but little more than a century since its composition was discovered. Dr. Priestly (whose grave is in Northumberland county in this State), discovered the element oxygen sometime in 1774, and Lavoisier in November of that year discovered that one-fifth of our atmosphere was this gas, oxygen. This was not two years before the Declaration of Independence.

The constituents of the air have been frequently determined with great accuracy, and are found to be almost invariable in their proportions, slight variations occurring in large cities, and great variations near volcanoes and other special regions of peculiar phenomena.

The constituents are, by volume:

Nitrogen,	79.02
Oxygen,	20.95
Carbonic dioxide,	00.03
	100.00

Aqueous vapor, a quite variable amount. Small and variable quantities of ammonia, nitric acid, hydrogen sulphide, ozone and sometimes other gases, are found.

The nitrogen, oxygen and carbonic acid of the air are not combined, and are of different density; but instead of being in layers, densest below, are always uniformly distributed in the above ratio in any space. In cases of liquid mixtures, we have two kinds of action. In one, as oil and water, the order of density is observed. In the other, as alcohol and water, each liquid spreads throughout the volume uniformly. In the case of gases, it is a law that all gases (which do not chemically combine) distribute themselves throughout the space occupied, each as if the others were not present. A denser gas will rise and mix through a lighter. This law of diffusion is of the highest importance to animal and vegetable life by the part it plays in arranging the constituents of the atmosphere.

Though carbonic acid forms but .03 parts in 100 of the air, its importance and the importance of its diffusion and presence everywhere are manifest; and likewise, the importance of the rather small constituent, aqueous vapor. But the immense importance of the part played in the physical phenomena of the heavens and the influence

on the life of the earth by some of the constituents named, of which there is never much more than a trace present, can be understood only by considerable study of the subject. (See absorption and temperature, under Solar Radiation, below.)

Structure.—We must consider not only the constituents of the atmosphere, but their structure, or the way they are put together and their relations and actions. Suppose a cubic inch of air in a tube, under a tight fitting piston. The piston, we find, is easily driven further down. Evidently there are spaces between the parts of the air, or the structure is one of particles and interspaces rather than continuous. This reduction of volume can be carried a great way, but demanding more and more pressure. What is the size of the particles, how far apart are they ordinarily, and how many have we in one cubic inch of air? As the result of a great deal of work and calculation, physicists have given approximate answers. In a cubic inch of air, at ordinary pressure and temperature, there are about 300,000,000,000,000,000,000 particles, each about $\frac{1}{2500000000}$ inch in diameter, and from $\frac{1}{100000000}$ to $\frac{1}{60000000}$ of an inch apart on the average. But each of these has a velocity of about 1,500 feet per second, so that it has about 8,000,000,000 encounters per second with other particles, changing its direction more or less each time. In all this, no two particles ever touch; but as they rush toward each other, before actual collision or contact occurs they are repelled with great force.

One cubic inch of air—No. 300,000,000,000,000,000,000 particles.
Size, $\frac{1}{2500000000}$ inch diameter.
Distance, $\frac{1}{100000000}$ to $\frac{1}{60000000}$ inch.
Velocity, 1,500 feet per second.
Collisions, 8,000,000,000 per second, each particle.

Everyone has seen a swarm of small gnats, of a summer evening, stationary as a body, but each individual in rapid movement. If we can imagine each gnat diminished a million or two times in size, and the average distances between the gnats several million times, with a corresponding increase in the number of gnats, and a great increase in the velocity of their movements, we may get some conception of what is going on in a cubic inch of ordinary air. Suppose, now, that whenever any two come near each other they by a thrust of wings or legs hurl each other away with quite a force. Now, if we inclose our swarm and try to bring them into less space, since each gnat has a certain weight and moves with a certain velocity, there will be millions of blows during each second against each square inch of the inclosing surface. This will be, in effect, a pressure of a certain amount, increasing as the space becomes less and a greater number per second of gnats strike or are hurled against each square inch of the surface.

Pressure.

By means of a globe suspended to a fine balance, (Fig. 3) we find that a cubic foot of air at 60° F. and ordinary pressure weighs about eight one hundredths of a pound. Though possessing this considerable weight, the air does not fall all into a compact covering about the earth. This is due to the peculiar constitution and structure that we have just considered. All the particles are strongly drawn toward the earth, but the continual rapid vibratory movements and the elasticity with which they rebound, prevent very close approach of the particles to each other. Still, those portions which beside the attrac-

tion of the earth are subject also to the force with which large amounts of overlying air are urged toward the earth, are considerably compressed. Thus the air is densest at the surface of the earth and grows rarer quite rapidly as the vertical height increases.

The density is everywhere as the pressure, if the temperature is uniform. This is known as Boyle's law. It is easily proven with a bent tube, Fig. 3, with the shorter part closed. The bend, a b, is just filled with mercury, and b d contains air of the same density as that without the tube. If mercury is poured in until the height h c gives as much pressure as the atmosphere (about thirty inches of mercury), the air in c d is under double pressure and occupies but half its usual volume. The relation is true for any ordinary pressures, the volume is inversely as the pressure. To state this in reverse order, the less volume that a given amount of air occupies the greater is the pressure on the surrounding surfaces. This pressure, as we have seen is due to the rapid blows of the almost infinite number of particles. When we get about three hundred quentillions of these in a cubic inch, at ordinary temperature, these blows give a steady pressure of fifteen pounds to the square inch.

Some Florentine pump-makers, and doubtless others, found they could only raise water about thirty feet high, by "suction," in their pumps; and that if the pistons were pulled much higher the water would not follow. They appealed to the philosopher, Galileo, for an explanation. The easy philosophy of that day explained the rising of the water by saying nature abhors a vacuum and tries to fill it; whether nature abhorred a vacuum only to the height of a little more than thirty feet, or whether she got tired of filling it and stopped there, I believe was never decided. Galileo knew that liquids transmit pressure in all directions undiminished and so that equal areas of the surrounding surfaces sustain equal pressures; so that a pressure on the piston P, Fig. 4, would be transmitted down the tube, then horizontally, then upward, and every area of W equal to P would experience a pressure equal to that on P. He knew that air had weight, and must press on the water in a well, Fig. 4, which pressure would be transmitted downward and horizontally through the water, and so would force the water up into the tube of the pump from which the air had been removed, moreover, it should rise until the pressure produced at the bottom of the tube by the column of water in it equals the pressure of the air (and water) outside the tube at the bottom of it.

One of Galileo's pupils, Toricelli, said if this was the true explanation, then the pressure due to the weight of the air should sustain a column of mercury, 13.6 times as dense as water, only one 13.6 part as high as the column of water. He filled a tube, Fig. 5, a yard in length with mercury and inverted it with the open end in a bowl of mercury. The mercury in the tube settled to about thirty inches above the surface of that in the bowl. To complete the proof, he asked a relative living near a mountain to repeat the experiment on the mountain. Here, above a portion of the air, the mercury in the tube stood at but twenty-seven inches.

Thus the action of the common pump was fully explained and proved to be due to the pressure of the atmosphere arising from its weight; and that pressure was also measured, since a column of mercury of one square inch section and thirty inches high weighs fifteen pounds.

Fig. 1.

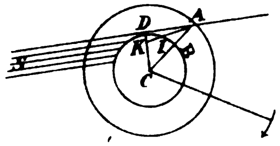


Fig. 2.

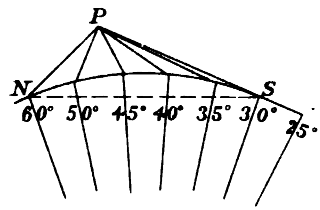


Fig. 3

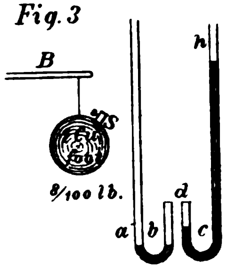


Fig. 4.

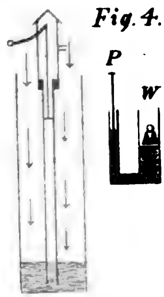


Fig. 5.

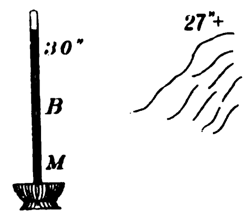


Fig. 6.

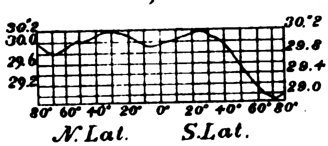


Fig. 7.

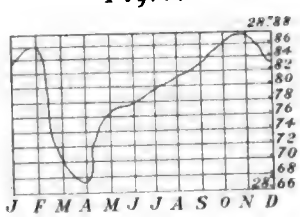


Fig. 8

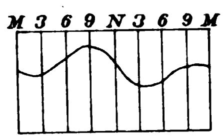


Fig. 9

1 Calorie = 772 foot-pounds

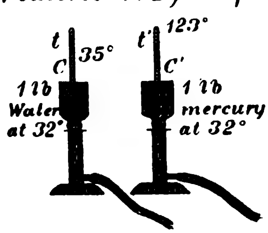
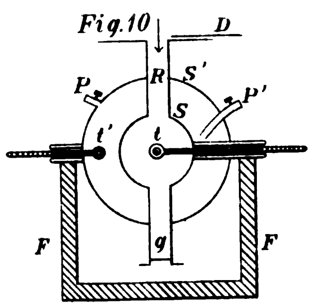


Fig. 10



I.T.O.

These experiments also introduced a most important instrument, the barometer. This instrument measures the varying pressure of the atmosphere. Its simpler forms are familiar to everybody. In the aneroid barometer, the pressure is measured by an index moved by the greater or less flattening of a curved cover of a tightly closed and exhausted metallic box. If a pencil is attached to this index and presses a sheet of paper drawn uniformly past it by clock work, it gives a continuous register of the varying atmospheric pressure. The mercurial barometer is made self-registering in a number of ways. One is suggested in Fig. 18, where a piston, P, floats on the mercury and works a lever, L, with a pencil marking on C, a cylinder driven by a spring clock and covered with a sheet of paper ruled horizontally for fractions of inches difference of level of mercury in tube and cistern, and ruled vertically for time.

The barometer has been of the greatest importance in the study of meteorology and the prediction of weather. A knowledge of the monthly and annual mean pressure of the atmosphere has greatly assisted to explain the more general and permanent or periodic phenomena of the winds of the earth, and the continual variations of pressure from day to day at different places are essential factors in weather forecasts.

Fig. 6 represents the mean annual pressure at different latitudes. It shows the greatest average pressure at about 35° N. latitude, with nearly as great a mean pressure about 30° S. latitude. Three zones of minimum average pressure are shown, the equatorial region, between 60° and 70° N. latitude, and about 70° S. latitude.

At any given place, the monthly means show maxima and minima, occurring pretty regularly from year to year. Fig. 7 shows the mean pressure of each month as found from the observations of several years at Pennsylvania State College. And the curve obtained from the observations of any one year, would not differ very greatly from the curve of Fig. 7.

And again, at any given place, the mean pressure varies with the time of day. Observations at Philadelphia, continued for a considerable period, show the mean pressures at the hours 0, 3, 6, 9, 12 (noon), 15, 18, 21, 24, as represented in Fig. 8.

Another regular variation of mean pressure, but of very little magnitude, is produced by the moon during each lunation.

Combined with these regular periodic changes of pressure are continually occurring irregular variations of pressure due to changes of temperature, humidity, and, perhaps electrical and other conditions of the air. So it is only by taking the means for a long time that the monthly, daily, or other regular periodic changes for any place can be found.

Solar Radiation.

Byron, though no scientist, has given a vivid picture, in his Dream of Darkness, of the conditions that would quickly follow the shutting off of the solar radiations from our atmosphere:

"The bright sun was extinguished, and the stars
Did wander darkling in the eternal space,
Rayless and pathless; and the icy earth
Swung blind and blackening in the moonless air.
* * * * * * * * * *
The world was void,
The populous and the powerful was a lump,
Seasonless, herbless, treeless, manless, lifeless,

A lump of death—a chaos of hard clay.
The rivers, lakes, and ocean all stood still,
And nothing stirred within their silent depths;
The winds were withered in the stagnant air,
And the clouds perished. * * * *"

We want to understand something about this wonderful process of solar radiation which causes nearly all the varied and never ending phenomena of the skies and is absolutely essential to all life, vegetable and animal on the earth. What are solar radiations, and their properties, and how do they interact with such an atmosphere as ours to produce the seasons and climates, the winds and rains, the pressures and temperatures, the vital conditions of this habitable and glorious earth?

We will take a ray, or beam, of solar radiations, R, Fig. 11, admitted to a darkened room, and passed through a glass prism, P. On a screen, Z S, we have a band, A Z, of brilliant colors, a spectrum, S. By experiments and reasonings and tests too lengthy to describe here, it is established that the original ray consisted of vibratory movements across its direction, in every plane, and of many millions different rates, or periods, of vibration and different wave-lengths, B, Fig. 11. These different vibrations are differently retarded, and therefore differently bent in passing through P, and so are separated into the band, or spectrum, S, which extends much farther at each end than the space covered by the colors seen by the eye.

Three methods are now possible to us for studying these radiations and learning more about their nature and properties. These are illustrated, typically, in Fig. 12, in which S is the spectrum from the prism. We may move any delicate thermometric instrument along S and observe its changes. We may note the difference to the eye along a portion of S, from R to V; the rest of it is not visible. We may put certain chemical compounds, as iodide or bromide of silver, in different parts of S and observe how they are affected.

Interesting as the study of color may be, and important as is the chemical action of the solar beam, both in the arts of life and in the processes of nature, we shall omit further notice of them, and consider only the thermic, or heat, effects of solar radiation.

Practically all the heat of the surface of the earth comes to it in solar radiations through the atmosphere. The amount of heat thus received annually is inconceivably great. To measure heat and say how much there is of it, we must take some quantity of heat as a *unit of heat*.

In the English system of measures, the *unit of heat* is the quantity of heat that will change the temperature of one pound of water one degree Fahrenheit. In Fig. 9 are two equal gas flames with two exactly similar vessels over them. In one vessel is a pound of water at 32° F., in the other a pound of mercury at 32° F., and in each a thermometer, t, t′. When the water has reached the temperature 35°, a rise of 3°, the mercury has a temperature of about 130°, a rise of 98°, nearly thirty-three times as great a change of temperature as was produced in the water, and yet both received the same *amount of heat*. So, we see that temperature read from a thermometer does not measure quantity of heat. Therefore, the *unit of heat* is taken as defined above.

Now this amount of heat, unit of heat, can be produced by friction or blows, in which there is just the amount of *work* done that is done in lifting one pound 772 feet high, or 772 pounds one foot high; and

Fig. 11

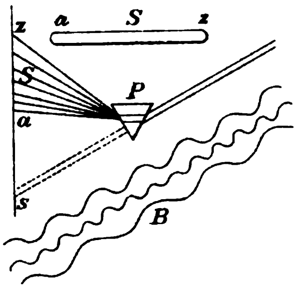
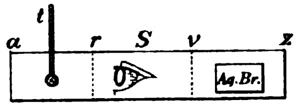


Fig. 12



a - 0.000118 inch
z - 0.000012 "
r - 0.000030 "
v - 0.000015 "

Fig. 13

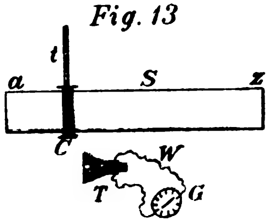


Fig. 14

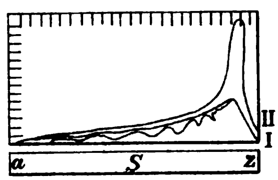
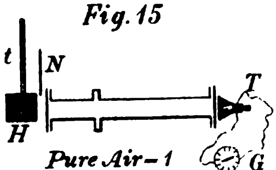


Fig. 15



Pure Air	– 1
CO_2	= 90
CH_4	– 403
SO_2	– 710
NH_4	– 1195
H_2O	– 14400

Fig. 16

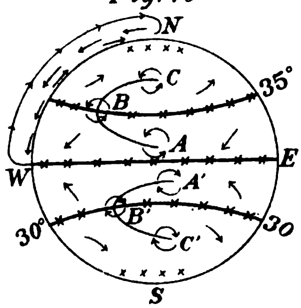


Fig. 17

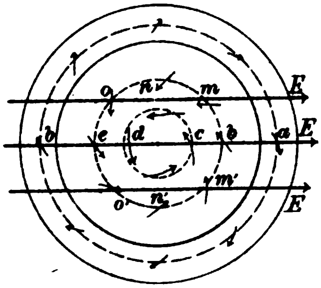
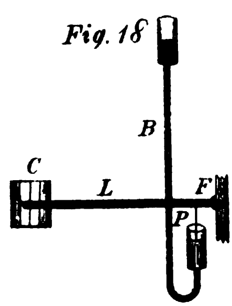


Fig. 18



I.T.O.

it is also found that for every *unit of heat*, calorie, used in the cylinder of a steam engine the piston does 772 foot-pounds of work. In general, a unit of heat is equivalent to, or will do, 772 foot-pounds of work. The ability of anything to do work is called energy. The energy of one unit of heat=772 foot-pounds.

"The observation of the amount of heat the sun sends the earth is among the most important and difficult in astronomical physics, and is also the fundamental problem in meteorology, nearly all whose phenomena would become predictable if we knew both the original quantity and kind of this heat; how it affects the constituents of our atmosphere on its passage earthward; how much of it reaches the soil; how, through the aid of the atmosphere, it maintains the surface temperature of the planet; and how, in diminished quantity and altered kind, it is finally returned to outer space." [S. P. Langley, Researches on Solar Heat, p. 11.]

This observation has occupied much of the labors of Herschel, Pouillet, Erricson, Crova and others, in the last fifty or sixty years. The latest and best work in this research is that of Prof. Langley, of Allegheny Observatory. Fig. 10 gives a view (vertical section) of an actinometer, used by Crova and by Langley. S and S′ are spherical shells between which water enters at P′, and discharges at P. Two tubes are inserted in S, and two thermometers, t and t′, pass through the tubular axes of support, one into S and the other into the water. The solar rays fall a noted time on t, and its change of temperature is noted. If, now, we know the amount of heat, in heat units, required to make any given change of temperature in the thermometer t, by finding the rate at which its temperature begins to change, we have the means of determining the amount of heat received per second on each square inch of surface perpendicular to the rays.

Langley gives the latest results of actinometric research. He says, "my conclusion is that we can adopt *three calories* as the most probable value of the *solar constant*, by which I mean that at the earth's mean distance, in the absence of its absorbing atmosphere, the solar rays would raise one gramme of water three degrees Centigrade for each square centimeter of surface perpendicular to them." [The calorie he uses is about 0.004 as much heat as that defined above.] "This would melt an ice shell 178.6 feet thick annually all over the earth. Somewhat less than two-thirds of this amount reaches us at the sea level ordinarily from a zenith sun," and increasingly less as the sun is nearer the horizon. "Yet the temperature of the earth's surface is not due principally to this direct radiation, but to the quality of *selective absorption* in our atmosphere, *without which the temperature of the soil in the tropics under a vertical sun would probably not rise above* —200° C."

The surface temperature of the earth, and with it the existence of our race, and of all organized life, are dependent on this *selective absorption*, a physical process in the atmosphere due to the physical properties of air and of solar radiations.

Returning to Fig. 12, we have the solar radiations separated and spread along a band, or spectrum, s, arranged in the order of some of their physical properties, wave-length and period of vibration. At a and z, the longest and the shortest wave-lengths yet measured, they are 0.000118-inch and 0.000012-inch; at r and v, the extreme visible parts, or colors, of the spectrum, the wave-lengths are 0.000030-inch and 0.000015-inch. If we take a very narrow vessel of water con-

taining a fine thermometer and expose it (Fig. 13) for the same length of time in different parts of the spectrum, we shall find the changes of temperature quite unequal, lessening notably toward the end z, and also very near the end a. If we weigh the water and take its changes of temperature in equal times along the spectrum, we can find the relative amount of heat received at each place, and from this, as explained above, the relative energy or working ability of the rays of different wave-lengths. Instead of a vessel of water and thermometer, a very much more sensitive and accurate apparatus (a *thermopile*, T, and galvanometer, G, Fig. 13) is actually used in such work.

Professor Langley greatly improved the construction of this apparatus, in a new instrument called a *bolometer*. With this he has very carefully measured the energy at every part of the spectrum, and plotted it by setting up lines proportioned to the energy at each part and connecting the tops of these lines; this gives the curve I, Fig. 14. He then went to Mt. Whitney, in the Sierra Nevadas, over 14,000 feet high, leaving more than one-third of the atmosphere below him, and again measured the heat along the spectrum, and plotted the energy of the different radiations when they had passed through less than two-thirds of the earth's atmosphere. From this, he determines what the energy of each part of the spectrum would be outside the atmosphere. The mean of his results is represented in curve II, Fig. 14. It is notably different from I, not only in greater amount, but in the distribution of energy. This shows that some of the radiations are much more absorbed than others by the air. While the radiations of great wave-length have nearly the same energy in both curves (at mean sea level and outside the atmosphere), those of short wave-length have lost a great part of their energy at sea level; or rather, a great part of these, two-thirds of some of them, has been absorbed by the air. The greater the wave-length, then, the greater the percentage transmitted through the air. Now when these radiations fall upon the earth they produce heat and so maintain the necessary temperature of the globe. To do this it is necessary that they should not pass out again through the air as readily as they were first transmitted. The highest temperature of the earth's surface gives radiations of much greater wave-length than the longest measured in the spectrum, and to these the atmosphere must be highly impervious. Their absorption by the air near the earth's surface heats this lower air; and thus the solar radiations that have passed through to the earth, and undergone a change at its surface, are largely retained and furnish heat where it is needed, at the bottom of the atmosphere.

Curve I, Fig. 14, is much notched, showing excessive absorption of certain radiations. It is found that very small percentages, or even a fractional per cent. of certain gases mixed with air, have a wonderful absorptive power for heat and light radiations. Fig. 15, H, is a vessel of hot water and a thermometer, t. The radiations pass through the long tube with glass or rock salt covers at the ends and fall on the thermopile, P. By the small lateral tubes, the air may be removed or different gases admitted. Tyndall found that if the absorption of heat radiations by one atmosphere of air was called one, that by one atmosphere of carbon dioxide (carbonic acid) was 90, marsh gas 403, sulphurous acid gas 610, ammonia gas 1195, and water vapor 14,400. The small portions of these substances in the air (the water vapor

sometimes being considerable) absorb very large amounts of solar radiations of certain wave-lengths.

Movements.

The atmosphere contains, approximately, 6,166,415,570,382,815 tons of air, and 3,854,009,731,500 tons of water, the latter being very roughly calculated.

We have found that the solar radiations pass through this in considerable proportion without much effect upon it, and their energy is expended in heating the surface of the earth and the lower atmosphere. The heat thus received per square foot of the earth's surface, one calorie = 772 foot-pounds, is 83 foot-pounds per second under direct rays of sun; or is equal to the work of a one-horse power engine on every six square feet: or taking the whole surface, parts of which are variously inclined to the solar rays and half of which, at any instant, is receiving no rays, is equal to one-horse power engine for every fifty square feet of the earth's surface working constantly. Part of this inconceivable quantity of work is spent in the growth of vegetation; another part, probably, in the production of magnetic and electrical actions; another part of it is spent in evaporating water from the surface of the land, oceans, lakes, etc., to the amount of hundreds of billions of tons annually, the evaporation of each ton requiring nearly two million calories of heat; other parts may be spent in ways we know not of; but finally there is a great amount of this heat energy expended in putting the several quadrillions of tons of air and vapor in the atmosphere into continual and sometimes violent movements.

As indicated above, at any instant of time the quantity of energy per square foot being received differs greatly over the earth's surface; and as the hours of the day and the seasons of the year change, the amount received at any given place is also continually changing. Thus the air is being continually lifted up against gravity and let down and this action varies in rate and amount from place to place over the earth. This, the elastic reactions of the portions of the air on each other, the rotary motion of the earth, and other causes, combine to keep the atmosphere in continual movements. Some of these are quite regular and periodic, others very irregular. The great excess of energy received in the equatorial regions at all times causes a continuous uprising of the air; the air from both sides flowing in to supply the place of that ascending, and in turn ascending, also, to flow over toward the polar regions, sink toward the earth, and again flow into the equatorial zone to re-ascend. This quite regular general movement is shown in Fig. 16 by the direction of the arrows. The upper current toward the poles divides about latitude 35° N. and 30° S., part descending and continuing toward the poles as surface currents; the return currents from the poles to 35° N. and 30° S. lying between these upper and lower polar currents. In the neighborhood of 35° N. and 30° S. there is a region of quite variable surface movement of the air according as the one or the other surface current advances or recedes, or they become mixed, with continual irregular fluctuations. The effect of the upward movement of the air near the equator and of the downward movement of a part of it near 35° N. and 30° S. on the mean atmospheric pressure is seen in the curve of mean pressure, Fig. 6. While this general movement is going on, the earth is turning around its axis, carrying the atmosphere with it, and thus the air mov-

ing toward the equator is constantly passing over regions moving more rapidly to the eastward than it is doing. This causes what would be south and north currents to become currents toward the south-west and north-west, Fig. 16. And beyond 35° N. and 30° S., where the air is constantly passing over regions moving to the east less rapidly than itself, the currents become toward the north east and the south-east.

Bearing in mind the general movement described, let a region of a few hundred square miles (Fig. 16) be excessively heated, making a very strong upward movement of the air, and inrush of air from around this place. The inward movement from all directions, combined with the general movement, produces a rotation counter-clockwise, as shown by the curved arrows. Thus a circular motion is given to a body of air of fifty, a hundred, perhaps two hundred, miles radius. This is a *cyclone*. The barometer is very low in its center; the upward movement considerably diminishes the atmospheric pressure. The heated air, often very moist, rising here, cools both by expansion and removal from the earth, and much of its vapor is condensed and falls as rain. This great rotating mass, in the midst of the south-westerly moving atmosphere, and on the rotating globe, is forced, according to well-known dynamical laws, to move along a curved path bearing north-westward, until it reaches the region of north-eastern movement, when its path turns in a curve to the north-east. Cyclones may start—originate—farther from the equator, even to the northward of 35°, and pursue but a part of the curved path. They gradually lose their rotary movement by friction with the surrounding mass of air and from other causes.

It follows that from about 35° N. up to pretty high latitudes, as in the United States, cyclones (the large storms that last several days) move north-easterly, or almost eastward, as up the Atlantic coast, just inland, or a little out at sea, and going off eastward over the Atlantic. Those originating in a higher latitude, as the upper Mississippi valley or Montana, move nearly eastward, a little tendency northward, and, if not spent, go off upon the Atlantic. The local physical features of the earth, mountains, large bodies of water, deserts, large forests, etc., vary, to some extent, the paths of cyclones.

Take, now, one of these cyclones (Fig. 17) moving easterly, as indicated by the large arrows E E E. Simultaneous observations of the direction and velocity of the wind always show, in a general way, the conditions represented in Fig. 17. In the region immediately surrounding the cyclone is the anti-cyclone, where the wind is blowing in all directions away from the cyclone, and is usually quite moderate in velocity. Then there is a circular region of very little movement (and high pressure, barometer). Within this is the cyclone, the wind from every direction blowing inward, with increasing velocity nearer the center, as indicated by the longer arrows, but nearly null in the central space. At a place located on the line of the upper arrow, E, the storm, preceded usually by a wind to the south-east, begins with a wind to the north-west, or nearly west, changing to a wind to the southward. At a place on the line of the central path of the cyclone, after a wind from the north-west usually, the storm begins with the wind from the south-east, with comparative calm following (as the *center* passes over), and then wind from the north-west. At a place so situated that the southern portion of the cyclone passes over it, after a northerly wind usually, the storm begins with wind from south-

east or south, and the wind changes (going clockwise) to south, south-west, west or north-west. The north and south diameter of a cyclone is usually greater than the east and west diameter, and the outline irregular.

The water which falls as rain at any place during the passage over it of a cyclone may have been evaporated from any large bodies of water (or much even from large forests or regions of heavy vegetation) lying in any direction, or at almost any distance, from the place of falling. Once in the air as vapor the winds may carry it first in one direction and then another, for small or for great distances, till finally caught in the cyclonic movement and attendant conditions it is precipitated as rain.

The atmospheric movements, maintained by the energy received in the solar radiations, are the great transporting agencies whereby the oceans, first lifted in the air also by solar energies, are continually carried over the continents to supply the vast demand of all the organic life of the world. Nor is it alone an ocean of water continually lifted by the sunbeams, transported by sun-impelled winds and ærial movements, and falling on all the land to water the earth that it may bud and bring forth. A ton of water, evaporated by equatorial heat, holds in its vapor an added energy, which is carried with the ton of vapor, and when this is condensed into water (rain) is given out as heat—about two million calories, or units of heat, as above defined. The evaporation of millions of tons of water daily in equatorial regions, where heat is received in excess, and the transportation of a considerable portion of this vapor to descend in rains in higher latitudes, where heat may be received insufficiently, is a system of heat-carriage and supply that would exhaust the mines and forests of the earth, and all the shipping and railroads of the nations in an incalculably short time. By it temperate climates and the productive area of the earth are greatly enlarged.

Little, if at all, can we control meteorological conditions and actions; but a knowledwe of the principles and laws of this domain may enable us to so manage and conduct our affairs that they shall work for us and not against us, and that we may do intelligently and efficiently our little part of working together with the Infinite Power in making the earth yield abundantly all that contributes to our physical and rational well-being.

SUGGESTIONS IN RELATION TO FORESTRY.

By Prof. W. A. BUCKHOUT, *State College.*

[Read at Bellefonte meeting.]

It is often said, to the reproach of those who advocate an interest in forestry, that they have nothing practical to offer or suggest, that they are mere alarmists painting in vivid colors the death and destruction which are to follow when our forests and our timber are gone, but that they totally fail when they undertake to devise practical means for averting the calamity which is to come. While I do not believe that the objection is well founded, it evidently behooves the advocates of forestry to step forward and present their case in as strong a light as possible. In brief, that case is this: The marvelous rapidity in the

increase of our population, and the consequent demand for lumber and wood, for various purposes, are making such drafts upon our timber lands that it will not be long before the supply will be exhausted in all the old settled parts of the country. The natural process of re-foresting is so slow and uncertain that but little value can be derived from it unless it is supplemented by the fostering care of man.

Besides their direct commercial value, forests are of marked benefit in that they are the most efficient conservators of our water supply that it is possible to have. I do not refer to the much disputed questions of the effect which forests have upon the absolute amount of rain which falls, but to the protection which they give to our streams, and to the conservation of our water supply in its general sense. Regarding this I think there is no doubt.

If, then, forests have this double function of supplying one of the most useful of the raw productions of the country, and of regulating its water distribution, what can be done toward keeping them in the most serviceable condition?

There are two ways: First, to allow and encourage by care and attention a second growth of timber; and second, to plant trees in large numbers, in other words to raise a forest as one would raise any crop.

To both methods there are several difficulties, the chief of which are that trees at best grow so slowly that they can scarcely be compared with ordinary farm crops or even crops of fruit, and so long a time is required before reaching a usable size, that they are subject to many and peculiar dangers; moreover, there is a possibility that the ingenuity of man, and discoveries yet to be made, may make the forest products of much less value than they now are. This looking forward into the distant future (distant to us I mean) is not an easy matter, but it seems scarcely possible for the peculiar protective agency of forests to be supplied by any other means than by the forests themselves.

If, then, we grant that the probabilities are all in favor of the perpetual need of forests, what more can be done towards their production than nature is doing alone.

We find that as a very frequent rule second growth trees are not of the same kind as the original; that a pine forest is succeeded by some less desirable species, and, moreover, the trees, whatever they are, are very often so few that they not only do not make rapid headway against the bushes and weeds, but that they tend to develop side limbs too much, and fail to make long, straight trunks, such as in later life will make the clear stuff, free from knots, which marks the best lumber; hence nature's process of re-foresting must be supplemented very much by man's effort. How practicable it may be to sow seeds of forest trees, or to transplant trees on a large scale, can never be known except by trial. There are some cases on record by which we can get a partial knowledge of results obtained within a limited time; not so complete as it is desirable to have, nor so conclusive; since, while they show unmistakably that forests can be raised by planting seeds or young trees, they do not satisfy us as to the best and cheapest methods for doing the work in mountainous regions like our own. It is not best to enter into consideration of these cases now, further than to say that they comprise planting under a considerable variety of conditions, in poor soil and in good soil, on shifting sands and on rocky hillsides, and in different parts of the country.

The few suggestions which I have to make are based chiefly upon

observation of some cases of natural second growth timber which is for some reason much better than the average.

It was twenty-one years ago that I first saw a small tract of second growth white pine on what we call the barrens in this county. I much regret that I did not then have sufficient forethought to measure the trees and make some estimate of the number upon a given area. I only remember that I was attracted by the vigor of the trees, their closeness, and the evident struggle which they were making with one another to see which would survive. They covered the ground to the exclusion of everything else; their trunks had already become divested of living branches below, and their tops made a canopy through which but little light fell.

At the present time this little tract still stands out in marked contrast to the mixed oak and pine about it. The trees are, of course, much fewer in number, but would still attract attention because of their symmetry, their closeness and the rapidity with which they are growing into first class timber. They average sixty feet high. Their boles are clean of limbs below, and for quite a distance further there are no living limbs, only the remnant of dead ones which are slowly dropping to the ground. Where no cutting has been done they still stand remarkably close, averaging five to the square rod, and measures near the base eight to fifteen inches in diameter. They still shade the ground so completely that but little undergrowth of any kind is possible. But few trees have been cut except such as were under eight inches in diameter, and hence were nearly crowded out and could not have held their places much longer.

By counting the rings of growth, these trees appear to be about forty years old, and as this seems to correspond with the recollection of the few persons who know their history, I think we may assume that this is very near to their correct age. At the present time they appear to be making not more than a quarter of an inch a year, while in the first ten or fifteen years they somtimes made one-half of an inch a year. But I was not able to find live, fresh stumps, nor stumps of the largest trees, by which to get accurate figures of this kind. It is certain, however, that the present rate of growth is comparatively slow.

I have tried to have practical lumbermen give me the value per acre of this young timber, but on account of the small size of the trees, which unfits them for general use, the most that can be said is that it is growing in value all the while, and is worth more to hold than for present use; if used now it would cut very much to waste, and is suitable only for a few purposes. Forty years ago then, this small tract of land received a shower of white pine seed from some old trees —a single one of these trees some four feet in diameter is still standing, and numerous old stumps and logs attest to the presence of others. Favoring conditions permitted a very large number of these seeds to germinate, and probably the young trees stood not far from one to the square foot of ground at the time when they obtained sole possession. Having gained this one point, complete possession, they entered upon a race and a battle with one another, and that is still going on, and will not end until the axe or fire of the lumbermen sweep them away. Such cases as these ought to be of special value in teaching us that what nature does so successfully by her own unaided efforts may be done fully as well, and upon a much larger scale, where the intelligent efforts of man shall be added. Brought down to a practical sug-

gestion, Pennsylvania has some thousands of acres of land which are poorly, if at all, adapted to cultivation, which are in various degrees of nudity and unproductivenes . Though once well forested, they have been stripped of all that was worth the handling and are now practically abandoned to nature. She does her best to cover their nakedness, but it is only here and there that it is done in just the way which most nearly meets man's necessity. Moreover, these lands, made up largely of our low mountain ridges, are so intercalated or even interlaced with the fertile arable lands through a very large part of the State, that we have the best possible relation between forested and cultivated areas. Happily, too, these mountain ridges offer little inducement to cultivation, and it is highly probable that in this wooded state they are efficient agents in equalizing our climate, as they certainly have been and are sources of wealth through their timber supply. It remains for us to see that the proper relation between our wooded and arable districts is maintained, and I wish to lay special emphasis upon the practicability of aiding nature to secure a thickly-set, vigorous stand of trees, whereby a greater number may be produced upon a given area, and such as will make the most valuable building material for use in the future. Herein is field for the labor of men with means and land, who are looking about for more worlds or woods to conquer. Amid numerous investments, why not make one, larger or smaller, in forest-planting?

A few words as to the objections which are generally given to such a novel suggestion. It will probably be said that much of this mountain land is so stony as to be totally unfit for any kind of vegetation, and that it would be impossible for trees to grow there. This is doubtless true of some places, but the areas of this kind are very much fewer and smaller than is generally supposed. I maintain that wherever it is possible to get trees started so as to make a slight shade and protection that there the accumulations of decaying leaves and branches and the disintegrations of the rocks will soon make a soil surface, thin perhaps, but thick enough to continue the life of the trees, and thickening as they grow. There is conclusive evidence that much of what is now the barren, shifting rock of our sandstone ridges was once covered with a very fair growth of trees, but upon their removal, or even without that, fire has swept in, and so thoroughly removed every vestige of organic matter that it will take a generation before any tree-growth can be established again. Further, it will be said that this danger from fire is so great and so constant that it renders any artificial planting on a large scale, and on our mountain lands utterly impracticable. This is indeed the most formidable objection that can be raised. Anyone acquainted with the facts must be forced to admit its value. It is a cause of great regret when we consider that these destructive fires are so often originated by selfish and malicious persons. The only suggestion I can offer on this point is to express the hope that the popular sentiment which we all recognize as so powerful for good or for evil may be influenced by the press, by local clubs and granges, by such meetings as this, so that we shall soon be able to perceive a changed feeling, and that people will come to realize that forests have not only a value to the immediate owner, but also a common value and a common interest to us all.

Says Prof. Sargent in the census report on the forests of the United States: "Fires do not consume forests upon which a whole community is dependent for support, and methods for the continuance of such

forests are soon found and put in execution." "The experience of Maine shows that where climatic conditions are favorable, the remnants of the original forest can be preserved, and new forests created as soon as the entire community finds forest preservations really essential to its material prosperity." If we accept the figures regarding forest fires in Pennsylvania by this same census report of 1880, we must admit that the room for improvement in this public sentiment is a very large room, for we are told that the property destroyed was valued at over three million dollars; that there were one hundred and twenty-nine destructive fires due to clearing land, one hundred and thirty-three to sparks from locomotives, seventeen to hunters, and (worst of all) one hundred and two to malice. May the efforts to bring about a better public sentiment in this respect be redoubled, until we shall no longer be compelled to record such humiliating facts as these. Still another objection arises in that the length of time required to get any return from money invested in planting and caring for trees is so great that few would be willing to run the risks. The difficulty, however, is rather in the feeling that it is not perfectly plain that at the expiration of a given time there will be value in the investment, and not that long time is required. The time is no longer than in some other business project, but this is to most men an entirely new idea. Many do not believe that forest trees can be grown as fruit trees in a nursery, or as ordinary field crops are grown.

There is a fallacious idea that forest trees so impoverish the soil on which they grow that a second crop of the same or similar kinds cannot be grown until some years have elapsed and the soil has been able to recuperate. Experimental plantations which would be of great service in showing what is possible in this direction are few and far between. For these and similar reasons men are slow to take stock in such an enterprise, although I apprehend there are some who would be willing to trade off some unproductive stock in more specious enterprises and run the risks in a forestry company. But what is the time involved? It will vary widely according to the kinds of trees, the soil and situation. I have presented some figures based upon the white pine. They indicate that it will be at least fifty to sixty years before timber of much value can be obtained. On better soil I believe this time would be considerably reduced. As a type of a more rapidly growing tree which is probably better adapted to our mountain land, particularly to the poorer parts of it, we may take the chestnut. Over a considerable part of the barrens before named the chestnut grows naturally, and occasionally one may find small tracts of young chestnut timber which is rapidly making a good record for itself. In all cases here at least this is sprout growth, and hence the trees are seldom as straight and symmetrical or as high as they would be if they had originated like the pines. The best of these trees are one foot in diameter near the base and are about twenty-five years old. The value of the chestnut for posts and the ease with which new trees spring up from the stump make it feasible to cut comparatively small trees to advantage. Upon some soils it is probable that black walnut will prove the best tree, and on the higher Allegheny plateau west of us the sugar maple and the beech seem well adapted; but of these particular trees I have only a general idea and cannot speak in detail. It has always seemed to me that the long time necessary to fully realize on an investment in forest planting would not be an insuperable objection whenever it is shown that the trees can be pro-

duced and that the need for and value of trees will be at least as great fifty years hence as now.

But since individuals seem so loth to undertake any such schemes on account of the expense and risks involved, why cannot corporations take hold of it? To this plan, which we owe to the Botanist of this Board, Professor Meehan, I wish to add the suggestion that gentlemen interested in hunting and fishing can, if they will, inaugurate forest culture to the great good also of their own organization for the preservation of game and fish. Let any one of the companies which buy or lease tracts of lands for sporting purposes not only preserve and protect the existing timber—which I believe they do because of its relation to the game—but also reseed and replant so large areas as their means will permit, and it will not be long before we shall have some fairly definite knowledge of the rate of growth of different kinds of trees, their value, &c., and some excellent examples which individual land owners may be willing to follow. A gamekeeper is of necessity something of a forester, and if game preserves should become a feature in our State it would seem feasible to have them serve as instructors in forest economy and their keepers to have under their special care the trees as well as the game and to arrest and have punished the poacher upon either. It may be that in this way we may have introduced into this country something of the spirit and method of forest economy as it has been so long practiced in Europe but which in its entirety seems not adapted to our American conditions.

Still another suggestion. By way of familiarizing people with forest tree planting, as well as for reasons before mentioned, special effort should be made in road side planting, not only on Arbor Day but on other days. When we see how much is added to our country roads where this practice is already common we wonder why it is not more popular elsewhere. In part the reason is found in that our system of allowing our highways to be the common foraging ground for domestic animals simply invites destruction of anything planted thereon unless extra and disproportionate expense is laid out in protecting the trees by boxes. In this respect, as in that of the forest fires, may we not hope that we shall soon see such a change in public sentiment that even the poor man's cow may lose the opportunity of worrying the life out of the prudent man's trees.

I am well aware that I have presented nothing really new on this subject to those who are familiar with it, but I trust that I may have presented some things in somewhat of a new light and attracted the attention of some who are or may be so situated that they can undertake some work of this kind. Pennsylvania, whose past prosperity has been so closely related to her forest products, ought not to fall behind in all reasonable efforts to sustain and revive an industry which seems to have nearly run its course and for which she has exceptionably good natural facilities.

THE TIMBER QUESTION AND WHAT TREES TO PLANT.

By E. SATTERTHWAIT, *Jenkintown, Pa., Pomologist of the Board.*

The subject, or rather science of forestry, as it may properly be called, has, of late, justly claimed a large share of attention from agricultural and climatic scientists. But notwithstanding so much has been said and written on the subject, its importance is not likely to be over estimated. And though, probably, there is not much that the deliberations of this body can do in the direction of accomplishing the great results that are confidently claimed as being within its scope, it may not be out of place to give it a small share of our attention. The value of timber, considered merely as a commercial product, is beyond all calculation, and is probably greater than that of any other one thing that could be named. But when we come to consider that besides this, upon the question of timber or no timber, depends in a great measure the value of all the land in the country for the purposes of agriculture, and that without trees a very large portion of our country must become a desert waste; that questions of climate, of extremes of heat and cold, of destructive atmospheric disturbances, of uniformity and regular distribution of rainfall, of the supply of well water, and of the flow of springs, and even of large streams and navigable waters are dependant largely on this question, we see, at once, that it is one of too great importance for any mere State institution or State legislature to cope with. And it is a source of gratification to know that our national legislature has done something if only a small beginning, in the direction of advancing this science. And perhaps the most we can expect to accomplish will be, by agitating the subject, to compel our representatives in the national legislature to recognize its importance. I do not profess to speak as an expert, having given only a little casual attention to the subject, and it is in reality a great science, one in which a life time could profitably be spent, but judging from my own observations and the opinions of those who have thus devoted their lives to its study, I am firmly assured that it is a subject more deserving the attention of our government than some others that now claim a large share of the national resources. With an annual appropriation commensurate with its importance, hundreds of millions of acres of territory now condemned as an irreclaimable desert and almost unfit for any agricultural purpose, could, with a comparative small expenditure in the planting and caring for forests, be reclaimed and become a valuable part of the public domain instead of a barren waste. This subject is surely one of sufficient importance of itself to justify the agriculturists of the country in demanding that their interests shall be recognized by establishing an agricultural department with a cabinet officer at its head. It would be out of place here to pursue further this branch of the subject. But it may perhaps be well in treating of the general subject of tree planting to give a few of the general conclusions which seem to be indisputably established. One of the most important of these is the effect that forests undoubtedly exercise on the amount and distribution of rainfall. This is easily understood when we reflect that rain is the condensed vapor that has escaped by evaporation from the earth's surface and that the amount of rainfall is, of course, limited by the amount of evaporation. The effect of an area of forest on evaporation is precisely

similar to that of a body of water. The tendency of both is to modify and equalize the amount of evaporation. The absorption of moisture by the atmosphere from a surface of water or of forest is uniform; that is, when the conditions are the same. Whereas the amount of evaporation from ground not so covered, is extremely variable. When the earth is wet, the heat of the sun during the warm seasons of the year, when vegetation is growing, causes a rapid evaporation from its surface, probably much greater than from either a surface of forest or of water. But when, on the other hand, the earth happens to become dry, evaporation from its surface falls off in proportion and in times of extreme drought, the escape of moisture from the earth, even under the hottest sun will not be equal to the amount nightly extracted from the atmosphere in the shape of dew, so that the expression, at such times, that "it has got too dry to rain," is quite correct. We can thus readily understand how, in a country where there are no forests, and far from any large bodies of water, rain becomes impossible and no form of vegetable life can exist. This explains how deserts are formed. Now let us see how this will apply to a country, as our is, diversified with cultivated farms, forests and streams of water. During winter and the cool months of spring and autumn, when not much rain is needed for the purposes of vegetation, we have generally an abundance. But when the summer heat begins it may, and generally does happen, that in some sections, the surface of the ground having dried quickly, a drought commences, and in a little while the whole surface of exposed soil affords so little moisture to the atmosphere that rain would not be possible, but that there are some areas, not too far removed, covered either with trees or with water, where evaporation still goes on. And so it very commonly happens that our summer local rains, upon which we have to depend so much for success in all our farming operations, most provokingly seem to shun the driest sections. The reason is, there is not enough moisture in the atmosphere in those sections to produce rain clouds. The whole subject is very simple when we come to look at it. The atmosphere absorbs moisture like a sponge and like other substances it expands with heat and contracts with cold, and when any portion of the atmosphere is suddenly cooled, as by coming in contact with a colder current of air, the contraction thus caused squeezes out the water, and this is rain. But if the atmosphere has been in contact with only dry earth it will not contain sufficient moisture to produce rain—the sponge will be too dry. Where a large portion of the earth's surface is covered with forests or bodies of water, the evaporation from these being constant, there is mostly a sufficient amount of moisture in the atmosphere to produce rain when other favorable conditions occur.

That the quantity of vapor given out by trees when in leaf is very great, is made evident by cutting off and exposing to the sun a branch with foliage in a hot summer's day, and see how quickly all the moisture in the leaves will be absorbed by the air. And this absorption is going on continuously during the day, from the whole surface of every leaf in the forest. During the hot summer day, every growing tree is drawing up a constant stream of water from the earth, and giving it out to the surrounding atmosphere where it is held as in a reservoir for future rainfall.

The comparative amount of water thus given out to the air between a surface of forest, a surface of water, and a surface of bare earth, or

one covered with growing crops, I have no means of knowing. nor am I aware that any attempts have been made to solve this very interesting and important question, but I should think it highly probable that the evaporation from forests, when we consider the immense surface of leaves exposed, every pore of which is constantly giving out particles of water during the day, must be far greater than from a surface of water. Fields of grass and grain and all other forms of vegetation, of course, are constantly giving out moisture through the day in clear weather, the same as trees, and in proportion to the amount of leaf surface exposed. Probably the greatest amount of evaporation from any surface is from that of moist earth. But the trouble with this, as well as with fields only partially covered with growing crops, is, that all moisture from the surface is so quickly dried out, and then evaporation nearly ceases; whereas, from a surface of forest or water, evaporation is the same at all times, under the same conditions. And thus it is that in regions devoid of these in times of drought, rain becomes an impossibility, until the occurrence of some widely extended atmosphoric disturbance may bring rain clouds from a distance. If all our cultivated fields could be kept covered during summer with growing vegetation, this would probably do away with the necessity of forests to promote rainfall. But the trouble is, that when a drought commences. all the grass fields begin to lose their green covering, and in a little while present only an arid surface from which evaporation almost ceases. Now, while this is so plain that it might be supposed to be familiar to every one who has given the subject a thought, yet is to be feared that if generally understood, its importance is certainly not appreciated. I have only mentioned one of the beneficial climatic influences produced by forests. There are several others that might be mentioned that are more or less important. But all are so easily explained and should be so well understood as not to need mention here. It being conceded then, that forests exercise a most potent beneficial influence to all agricultural pursuits, in the promotion and distribution of rainfall, in the preventing of the drying up of springs and wells, in affording barriers against inclement and destructive winds, and in many other ways exercise a most important beneficial climatic influence, it becomes a question worthy of most serious consideration how to promote an interest in their culture and extension and arrest the imminent danger of their almost total extinction from a large proportion of our country. It is not enough to prove the great public advantage of a work like this. Men will not spend their time and money to any great extent for the public benefit. There must be some individual inducement, some hope of personal gain to accomplish much in that direction.

As to what might be done by State legislative enactment, I will not undertake to advise, as I confess to not have given the subject much thought. Very much, I believe, has been already accomplished in some States, and some little in our own, which might perhaps be followed by more important and effective measures. The exemption of forest lands, to a certain extent, from taxation, might perhaps be well, and surely some effort should be made to have our forests better protected from railroad and other fires, which are now destroying them faster than all other causes combined. I find I have already taken up so much of your time that I shall not have much space to devote to what I had chiefly in view when I commenced this paper,

that is, to try to interest farmers in planting trees for their own benefit.

The love of trees for their own sake, for their natural beauty, for the pure and unalloyed pleasure to be obtained from their culture, in watching their growth and development from year to year, in the enjoyment of their healthful and delicious fruits, their grateful shade in summer and protection from the piercing winds of winter. These should be enough of themselves to inspire the natural instincts of every well regulated mind to become interested in tree culture, and surely there cannot be the owner of a farm but who feels an interest in this subject. With very many, however, the interest felt is not sufficient to induce any great sacrifice of time or means, and many of these are more indifferent to the subject than they otherwise would be from not knowing what and where to plant. It is to these I would speak, and this is indeed a most important question connected with this subject, and one not always easy to answer. I will not undertake to do this for all, but will only try to throw some light on the subject.

I think every one will agree with me that a farm, entirely destitute of trees, would be a most dreary, forlorn and undesirable place for a human habitation. The first thing to be considered when we come to provide for this deficiency is, for what purpose do we want trees? Aside from their general and public usefulness in matters pertaining to the climate and public health, these are for their fruit, for shade, for adornment, for protection from inclement winds, for fuel and for timber, and in this last I include fencing and all the many other important and indispensible purposes for which wood is used. The first of these topics, fruit trees, I do not propose to treat of here, as I have elsewhere frequently given my views on this subject, and to do it justice would require a paper of itself longer than would be admissible here. On this head I will only say here what I have long been trying to inculcate, that no farm should be without a fruit garden of at least an acre, devoted to the culture of all kinds of fruit and vegetables. This, if properly managed and worked with the plow and horse cultivator, need not require much more care and attention than that much corn, and if proper judgment has been exercised in the selection of varieties, it will afford a profusion of fruits and vegetables for the home supply, and some to spare, with less labor than is commonly bestowed on the small kitchen garden, which affords but a very meagre supply.

A few shade trees are essential about the house and buildings. For this purpose, some of the varieties of maples are most frequently used. Of these the Norway is perhaps the most ornamental, as its growth is very compact and symmetrical. The sugar maple is a taller growing and handsome shaped tree. The silver maple is a much faster growing tree than either of these, but does not grow compact, and should be headed back occasionally to make a handsome shaped tree. Where a very fast growing tree is wanted, the Carolina poplar or cottonwood is now much planted. This also requires to be headed back every few years Perhaps the handsomest of all shade trees is the weeping willow, which is also a rapid grower, but it is objectionable about a house on account of always dropping, either its leaves or small twigs. A few evergreens are indispensable about the farm buildings. Besides being essential as wind brakes, they are quite ornamental in winter, and add greatly to the beauty of the land-

scape when all other green things have disappeared. A belt of these should always be planted so as to protect the house and grounds adjoining from the north and west winds. They should not, however, be planted very close to the house, as their shade there in winter is not desirable. The very best evergreen for this latitude is the Norway spruce. This so completely fills the bill that it seems hardly worth while to mention any others, though there are scores of them to be found in the nursery catalogues. Though none of them are as good in every respect as the Norway spruce, yet for the sake of variety, in a large place, a few others might be admitted. The Austrian pine is a good hardy evergreen, but rather coarse in appearance, and only adapted to a very large lawn. There are a few of the other pines, and some of the arbor viteas that are hardy, aud some of these make handsome ornamental trees, and are useful where variety is wanted, but, by far the greater part of the evergreens named in tree catalogues are not adapted to our climate, and are comparatively worthless here. For an evergreen hedge, or screen, our native hemlock spruce is perhaps the best. There are quite a number of fruit and nut-bearing trees, which, though not adapted to the fruit garden, are worth having for their fruit, and some of these are just as good for shade and ornament as the worthless maples and other shade trees that are commonly planted about the house and lawn. Some of the fine varieties of our native chestnuts are quite valuable for their fruit, and make as good a shade tree as any other for planting about the farm buildings. They do not graft as easily as most fruit trees, but it can be done. The English walnut is not an unsightly tree, and is fast growing and bears a very desirable fruit. They should be grafted with a good bearing sort, but it requires an expert to do this. The sweet cherries that do not thrive so well in the fruit garden are fast growing and well adapted for a shade tree. Our native persimmon I consider well worth a place in the lawn. I have some varieties of them that ripen very early in the fall, and I know of no more delicious fruit. They are easily grafted. The Japanese persimmon is an extraordinary fine fruit, but will not stand the winter here. There are some of our native black walnuts with very thin shells full of meat that are well worth planting; but the black walnut is very poisonous to most other vegetation, and should only be planted in a meadow where nothing but grass is to be grown. They are very hard to graft. The mulberry is a fruit not to be despised, and I consider it worth a place in the lawn. Amongst the many varieties of our native plums that have been lately introduced, there are some that are very productive, and the fruit is quite useful as well as ornamental. They are well worth a place about the farm yard or lawn, as are also a number of the newer varieties of the Chinese and Japanese pears. In fact, there are so many kinds of fruit and nut-bearing trees that are as valuable for shade and ornament as the worthless kind commonly planted, that it seems hardly worth while for the farmer to plant any others for these purposes, except the indispensable evergreens, and it may be a few shrubs and other small trees for ornament. For the purposes of wind brakes, as well as for shade and their valuable fruit, I would plant along every lane and roadway on the farm, some fine variety of chestnut. The advantage of these as wind brakes in winter, and for shade in summer, will more than compensate for the loss in farm crops from the harm done by their roots, and if grafted trees of the

best variety are planted, their fruit will repay many times over all their cost.

We now come to the subject of planting purposely for fuel and for timber. If all, or nearly all, the native forest has been stripped from the farm, this should be considered an absolute necessity. But I shall be compelled to treat this very important branch of my subject very briefly.

In determining the question whether any, or how much, of the farm could be profitably devoted to this purpose, there are several important considerations to be taken into account. Where land is very valuable for farming purposes, and coal a reasonable price, it may not be advisable to set apart any ground especially for fuel or timber. A few rows of chestnuts along the lanes and roadsides or boundary of the farm, as I have suggested, will soon afford sufficient fencing timber. It may be thought, that in this country where timber is still so abundant, that the time has not yet come for practical foresting, but I am well persuaded that I could give no better advice to the farmers of this State than to give this subject their serious attention. There are few farms but could profitably spare a small part for timber purposes, and on very many a considerable portion could be used to no better advantage. Ground the least fitted for farming will commonly answer well for growing timber if judiciously planted. A steep hillside, an irreclaimable ravine, a soil so full of rocks as to forbid satisfactory cultivation, can be made to produce a valuable crop of trees. Where ground of this character is already forested, it would, in most cases, be extreme folly to clear it for farming. Very commonly the value of timber can be greatly enhanced where the native forest has been cut and left to renew itself, by cutting out the most worthless sorts and planting valuable timber trees in their places. This would not be an expensive work, as trees so planted grow well without further care.

The first consideration in planting is, of course, in determining what kinds to plant. As to that, I will not, as I have said, speak for any but that section of country that I am familiar with; I mean southeastern Pennsylvania. For that I know of no timber tree that possesses so many valuable properties, especially for the purposes of the farm, as our native chestnut. It is of very rapid growth. It will grow and thrive on the poorest soil. For fence timber I know of nothing to compare with it. It lasts longer for posts than almost any other that we have, and splits freely into rails, which will last almost a century. When fresh cut it is so soft and easy to work that I well remember how I used to consider it fun rather than work to go into the woods and cut and work up chestnut into fence posts and rails. Though the wood of the chestnut is so soft, when green, it becomes sufficiently hard when seasoned, and will take a high polish, and is much used as an ornamental wood. Perhaps its most valuable property is that the sap wood is as durable as any part, and on that account it makes the best of fence posts as soon as large enough, and the branches and young wood are very valuable on the farm for bean poles and other stakes. It also makes good fire wood, never decaying or becoming worm-eaten and worthless for fuel as most other wood does if left long exposed to the weather. Another valuable property of the chestnut is, that when cut, it sprouts up at once from the stump and soon re-forests the ground with the most valuable of timber. Though I have found no timber tree so valuable as the chestnut for

my immediate locality, I would not discourage the planting of others that might prove even more valuable elsewhere. The locust makes a more lasting fence post, and if it were not so liable to be utterly ruined and destroyed by the borer. I would recommend a small plantation of it on every farm. There may be some locations yet where it will do. The most durable wood for posts that I have had any experience with is our native mulberry. But whether it would amount to anything as a forest or timber tree, if planted and cared for as such, I do not know. but should think it well worth trying. The black walnut is a very valuable timber tree, and grows very rapidly in a rich, deep soil. And where such ground is not worth too much for other purposes a plantation of them would be a profitable investment. The most valuable wood for fuel is the shellbark hickory, and where wood has to be depended on for this purpose, these should be planted. It is a very valuable wood also for other purposes, and grows fast in a rich, moist soil. In many locations it would pay to grow it. The oaks take too long to mature, and on that account cannot be recommended for planting. It is only the heart wood of the white oak that is durable, and it takes at least a century for one to get large enough to be of much account. There are, of course, many other trees valuable for fuel and for timber, such as the ash, the elm, the maple, the beech, the sycamore and others. And some that I have not mentioned might prove more profitable in some localities than those I have recommended. It is with timber trees, no doubt, as we find it to be with fruits, those that do best in one location will not thrive at all in another, even where no essential difference in soil or climate is apparent. And it will be well for any one about to plant to use his own judgment in determining this question. I have only attempted to throw out some hints that might, perhaps, be useful, and I wish it always understood that I am speaking to farmers who may be supposed to wish to plant only for some purpose of practical utility. The landscape gardener and the wealthy landowner, who desires trees in great variety for ornamenting and beautifying his grounds, will, of course, seek for information in the many books that have been published on the subject, and the innumerable tree catalogues that everywhere abound; my object here is solely to try to induce farmers to look into this matter and give it the attention that its importance calls for, and if we can succeed in this I feel sure that a great step will be gained in the solution of this momentous question.

It may be thought strange that I have entirely omitted saying anything upon what is undoubtedly the most important phase of the "timber question" in this State—the imminent danger of the almost total destruction of the timber in the vast lumber regions, comprising the mountain districts of the State, and the consequent extinguishment of one of our great sources of wealth.

This branch of the question has been so often and so ably brought to the attention of our people by those who have had much better opportunities of studying the subject, that I thought it best to confine myself to a few points of minor importance, but which were more within the scope of my own observation.

I feel that I ought not to close this paper without at least alluding to the praiseworthy efforts on behalf of forest protection and extension by a few public-spirited citizens of our State, in the formation of an association to promote the objects, and I cannot do less than ask for the "Pennsylvania Forestry Association" the indorsement of this

meeting, and from our people all the aid and encouragement they can afford to so commendable a work.

REPORT OF DEPARTMENT OF HYGIENE AND FOOD INSPECTION.

By HENRY LEFFMANN, M, D., *Microscopist and Inspector.*

The following notes are contributed as a summary of a few of the more important developments in this field during the past year:

Adulteration of Food.—Public interest in this subject has been very strongly attracted to this topic by the discovery of extensive use of chrome-yellow as a coloring matter in buns, sweet cakes and noodles, the material being intended as a substitute for eggs. That this body was in more or less use as a coloring agent, especially in candies, has long been known, but it was supposed by many to be harmless, because of its insolubility. In the early part of May last, Dr. David Denison Stewart, Chief of the Medical Clinic at Jefferson Medical College, attended several cases of obscure disease, accompanied with convulsions, in a family by the name of Dieble. Four children died, two under the care of Dr. Stewart and two under that of other physcians. Peculiar appearances in one of the cases Dr. Stewart attended, induced him to suspect lead poisoning, and he made a search for a source of contamination from that metal. After much inquiry, the details of which will be found in papers in the *Medical News* of Philadelphia, he decided that the source was in the breakfast buns which the family had consumed largely, having purchased them from a baker named Palmer. He immediately visited Palmer's shop, and in the course of his inquiry found that the baker's wife was also a sufferer from lead poisoning. By persistent search he found that the baker was in the habit of using a notable quantity of chrome-yellow as a substitute for eggs, and that he had pursued this practice for a long time. With a view of establishing the chemical character of the articles, Dr. Stewart placed in my hands samples of buns, cakes, coloring matters, flour, etc., obtained at Palmer's shop, and I found upon analysis that his conclusions were entirely justified, and that the use of this lead compound (chrome-yellow being lead chromate) was the cause of the fatal cases in the Dieble family.

The facts having been clearly ascertained, the matter was brought to the attention of the district attorney of Philadelphia, and by him to the coroner, who ordered an exhumation of several of the bodies and a post-mortem, with toxicological examination. Dr. J. J. Reese and myself were appointed for the chemical examination. While the work was in progress, the great public interest caused numerous other cases of similar character to be brought to the notice of the authorities, and the viscera of six different persons were submitted to Dr. Reese and myself before the examination was concluded. The results established the facts absolutely, lead having been found in the livers of three of the bodies examined. Two bakers—Palmer and Schmid—to whom the use of the chrome-yellow was traced, have been held for trial. Dr. Stewart's attention having been drawn to the very yellow color presented by samples of "noodles" sold in this city, sent a package to me for examination, and I found as much as three grains of chrome-yellow to six ounces of the noodles. The manufacturer of

the noodles was arrested, and at the hearing admitted that he had used the coloring matter for thirteen years.

Pursuing his investigation, Dr. Stewart has succeeded in obtaining the clinical histories of seventy cases of lead poisoning due to the use of the dye-stuff by the two bakers above referred to. When we consider that at the inquests it was shown that the use of this compound had been very general, and had continued for a number of years, it is obvious that it has been a source of much harm. No more important public service has been done in this city for this year than Dr. Stewart's work in calling attention to this dangerous adulteration. One result of the exposure has been to show how entirely insufficient is the present condition of the law on the subject of food adulteration.

The Adulteration of Milk continues to attract great attention. In spite of the laws in some States, more or less alteration of composition by abstraction of cream or addition of water is continually occurring. This is serious enough in itself; but a more important question is the possibility of milk being a carrier of contagion. That several of the common infectious or contagious diseases—*e. g.*, typhoid fever—can be conveyed by this means seems to be generally admitted by sanitarians, and some recent researches made in England seem to give a promise of tracing directly to the cow the origin and spread of scarlet fever.

Food Preservatives.—The use of these agents is becoming very common, and the time is not distant when the interests of the public health will require legislative supervision over the matter. Salicylic and boric acids are apparently the most used substances, especially the former. Many articles of food of a perishable nature can be preserved with ease and certainty by this acid, and the temptation to use it freely is therefore very great. Canned fruits, fruit butters, catsup, milk, beer and wine are all liable to contain it. Although experiment shows that to persons in average health moderate doses do not seem to produce any serious effects even after a long use, yet all sanitary authorities are agreed that the indiscriminate and secret use of it is objectionable. K. B. Lehmann, of Munich, studied the effects on two male adults, who took, during a period of ninety-five days, nearly every day, about seven and one-half grains of the acid. He found no unfavorable results. Nevertheless, he regards the use objectionable, for the following reasons: It may be injurious to persons not in good health. There is no easy process for exact quantitive determination, and it will be difficult for proper control over the extent to which it is used. Its use will be extended to many articles of food, and thus the proportion will be dangerously increased.

Within the past month I have examined thirteen samples of bottled beer, with the result of finding salicylic acid in seven of them.

Poisonous Food.

It has long been known that food, otherwise entirely wholesome may suddenly become violently and even fatally irritating. The efforts of chemists to discover the cause of these actions have generally been fruitless, but lately the improved methods of investigation, and particularly the great advance in the knowledge of organic chemistry, has enabled a more precise analysis, and considerable light has been thrown on the topic. Many years ago it was shown that in the incipient decay of organic matters, especially nitrogenous matters, compounds analogous to the so-called alkaloids, were formed. We owe to Brieger a careful investigation into this question, and additional

light has been thrown on it by the researches into the growth and development of microscopic life. Dr. Vaughen of the University of Michigan, has isolated the principle which gives to milk and cheese their occasional active poisonous character, and he has called it "tyrotoxicon," although it has since been identified with an artificial benzine derivative that had been previously prepared. The investigations of Brieger and others have developed quite a list of these products of decay, to which the generic name of "ptomaines" has been applied. Among the interesting points made known by this observer, it may be noted that the most poisonous bodies are formed in the early part of the putrefaction and in the presence of air. Late in the progress of the decay, or when it occurs at low temperature out of contact of air, no highly poisonous ptomaines could be discovered.

The most important results obtained are those relating to the production of alkaloids by pure cultivations of pathogenic (disease-producing) bacteria. The typhoid bacillus of Koch and Eberth, and also the microbe which has been recognized as the primary cause of traumatic tetanus, produced toxic alkaloids; that produced by the latter organism has been called *tetanine*. It causes all the symptoms of tetanus.

In a recent lecture on this subject before the *Society of Chemical Industry* of England, the distinguished chemist, Henry E. Armstrong, showed that these questions are most intimately related to the establishment of rational etiology and therapeutics. The alkaloids produced by putrefactive change, and particularly those developed by the action of micro-organisms, are deserving of close study by physiologists, for the course and symptoms of zymotic diseases may to a large extent be due to the toxic properties of the alkaloids alone. It is obvious from this point of view a large field for valuable investigation lies open for the future observers.

Bacterial Studies.—Continually increasing interest attaches to the investigation of the form, life history and actions of the various species of micro-organisms. The last year has furnished some very important results in reference to the influence of the different species on one another. While there is not absolute exactness, yet in our knowledge on this topic, several observers have shown that in developing in ordinary culture fluids, some species of microbes will crowd out and destroy others. Several of the disease producing bacteria are liable in this way to be killed off by the ordinary microbes of the water and soil, and this fact has, of course, an important bearing on natural hygiene. The spread of contagious diseases has often, probably, been interrupted by the beneficial action of the harmless bacteria, which are ever present in water, air and soil. As an interesting outgrowth of this phase of the question is the study of the action of one form organism exercising a protective influence against another form. The experience of mankind early demonstrated that several diseases are self-protective, one attack generally preventing a second. The facts of vaccination are also illustration of this curious protective effect, but in this case there is but little doubt that if vaccinia is not identical with small-pox, it is closely allied. Much more remarkable is, however, the possibility of one form of virus exercising a protective action against an entirely different disease. Dr. Emmerich of Munich, has contributed very lately to the *Archives of Hygiene*, an elaborate study on the effect which prior inoculation with the specific microbe of erysipelas has upon the course of the highly contagious and fatal disease

known as splenic-fever. Emmerich's experiments were made, of course, on small animals and he selected those which were specially sensitive to the splenic fever bacillus. In his paper he gives in detail the precautions taken to secure accuracy in every particular, and from his well-known reputation as a bacteriologist, and the great facilities which his laboratory affords, there is no doubt that his results are worthy of full confidence. He finds that a previous, or simultaneous inoculation, by the micro coccus of erysipelas, of an animal inoculated with active splenic-fever virus, produces an undoubtedly favorable influence on the course of the latter disease. That this is due to a specific action, either directly or indirectly, on the development of the bacilli of the fever is shown by the carefully prepared sections of tissues of animals which have been killed during the progress of the experiments. In these the splenic-fever bacilli are found in a dead or dying condition as evidenced by their failing to take a permanent stain by the usual staining process, while in animals which have not been previously inoculated with the erysipelas, the bacilli were in active life. Emmerich believes that this action is not due to any direct hostility between the two forms of micro-organism, because as he states, when grown together in a culture-tube, they do not interfere. He regards the action as more complex, and as dependent on the function of the tissue cells. The tissues, he says, are stimulated to higher and more energetic vitality by the presence of the erysipelas microbe, and are thus enabled to resist and overcome the subsequently introduced germ of the fever. Whatever may be the true explanation of effect, the fact remains that this research is of great importance and interest to all. At the conclusion of his paper he remarks that he has in course of preparation some further work on the same subject which will be more practical in its bearing than even the present paper.

Bacteria in Water.—The nature and significance of the microscopic life in water has been extensively studied. It has been mentioned above that different forms of bacteria will often interfere with one another when growing together in water, and considerable attention has been given to this phase of the question, because of the obvious importance of this matter in reference to the propagation of infectious disease by water. The results are, however, still somewhat uncertain, but it appears that ordinary water is not a very good soil for the development of the more dangerous forms of microbes. While, however, these may not grow or multiply, it appears that they may lie inactive, especially in the spore-form, for considerable time even in the presence of the ordinary bacteria.

The value of the determination of the number and character of the bacilli present in water is still unsettled. There is no doubt that much light may be thrown on the effects and usefulness of various systems of filtration, storage and purification, but it has not yet been shown that it is possible to determine by counting the bacilli in a water whether or not that water is wholesome or unwholesome. In fact the problem of water analysis is still unsolved.

The observations of several chemists, especially Percy Frankland, have shown that very material improvement in the condition of any sample of water as regards the bacterial life in it, results not only from filtration through moderately compact material, but even from mere agitation with some easily subsiding powders. Also it appears that the addition of a few grains of alum to the gallon of water will

remove a very large proportion of these microscopic life in a short time. There is, therefore, no difficulty in clarifying and greatly improving the most turbid water.

Microbes in Air.—The microscopic life in the atmosphere has not received the general attention that has been given to that in water, but a number of researches on the topic have been published Very recently Prof. Carnelley of Dundee, and Mr. J. S. Haldane, have published the results of some extended experiments on air of buildings and sewers, and have indicated some remarkable facts. They have found that the micro-organisms do not get into the air of rooms from the bodies or breath of the persons present, but from the floor and other parts of the room itself. They also find that as regards the number of micro-organisms, sewer-air is much purer than the outside air in summer. The authors of this paper inveigh very strongly against the much preached doctrine of sewer-air causing typhoid fever.

THE ACTION OF ALCOHOL ON BUTTER FAT.

By Prof. C. B. COCHRAN, *West Chester, Pa., Microscopist of the Board.*

In order to test artificial butter for added butyrates it has been recommended that the suspected sample be treated with alcohol, which will dissolve any artificial tributyrate. If the undissolved fat then be tested by Reichert's method we shall find the per cent. of volatile fat acids much less than in the original fat, in case any artificially prepared butyrates have been used.

If this plan of examining suspected butters is ever to be called into practical use it is in my opinion highly desirable, if not absolutely necessary, that we have some definite knowledge of the action of alcohol upon genuine butter fats under certain fixed conditions, such as could easily be adopted when examining suspected samples.

The following experiments were made for the purpose of determining what changes if any were produced in butter by treating it with ethyl alcohol. The alcohol used gave a sp. gr. corresponding to 90 per cent. C_2H_6O. The amount used was 10 c. c. alcohol to each gramme of butter fat:

Sample.	Fat dissolved by 10 c. c.	Temperature.	c. c. $\frac{n}{10}$ K H O required for distillate of 50 c. c. from $2\frac{1}{2}$ grammes (Reichert's method).		
			Butter Fat.	Dissolved Fat.	Undissolved Fat.
1	0.1083	78° F.	13 c. c.	24 c. c.	
2	0.1086	78° F.		$25\frac{3}{10}$ c. c.	$9\frac{1}{2}$ c. c.
3	0.130	76° F.	11 c. c. $10\frac{1}{2}$ c. c.	$19\frac{1}{2}$ c. c.	$9\frac{2}{10}$ c. c.
4	0.120	75° F.	$15\frac{7}{10}$ c. c.	$27\frac{7}{10}$ c. c.	$13\frac{1}{10}$ c. c.
5	0.126		$12\frac{8}{10}$ c. c.	$28\frac{4}{10}$ c. c.	$12\frac{3}{10}$ c. c. $12\frac{4}{10}$ c. c.

Sample No. 4, giving in one case only $10\frac{1}{2}$ c. c. and 11 c. c. $\frac{n}{10}$ K H O in another to neutralize the distillate from $2\frac{1}{2}$ grammes of fat was

more than ten months old. In a third test of this same butter known to be genuine, $10\frac{1}{2}$ c. c. $\frac{n}{10}$ K H O were required. This butter was at the time in a state of good preservation, and was perfectly palatable.

Hehner & Angell, in their work on butter analysis, found that the insoluble fat acids of butter increased somewhat with age. This being the case we might expect some decrease in the per cent. of soluble fat acids, and this result, therefore seems to be in accord with the report of Hehner & Angell.

Three other samples of butter, tested in a similar way, but no attention paid to the condition of temperature, gave results as follows:

SAMPLE.	Per cent. of volatile fat acids in		
	Butter Fat.	Undissolved Fat.	Dissolved Fat.
1	$6\frac{3}{10}$ per cent.	$5\frac{23}{100}$ per cent.	$10\frac{15}{100}$ per cent.
2	$5\frac{96}{100}$ per cent.	$3\frac{1}{10}$ per cent.	$14\frac{43}{100}$ per cent.
3	$5\frac{32}{100}$ per cent.	$2\frac{71}{100}$ per cent.	$11\frac{87}{100}$ per cent.

If one suspects a butter of being adulterated with an artificial butyrate, and attempts to dissolve such an adulterant by the use of alcohol it seems necessary to use an alcohol of known strength, and to have a known quantitive relation between the alcohol and butter fat employed. If the fat, undissolved by alcohol, be then examined he must expect to find the quantity of volatile fat acids diminished somewhat even in genuine butter.

Using the method I have adopted, I should judge that the undissolved fat of a genuine butter ought to require 9 c. c. $\frac{n}{10}$ K H O to neutralize the usual distillate from $2\frac{1}{2}$ grammes. If less than nine are required, there would be reason to suspect adulteration.

I am inclined to think that more information would be gained by applying Reichert's method to the fat undissolved by alcohol than by applying it to the original fat if we adopt 9 c. c. $\frac{n}{10}$ K H O as the amount of alkali required to neutralize the distillate from $2\frac{1}{2}$ grammes of fat, strictly following Reichert's method. This would, in most cases, show at once the adulteration even in case of an added butyrate, when the same method applied to the suspected butter would not detect this.

The per cent. of volatile fat acids in the above table, was determined in each case by the process of repeated distillations and calculated as butyric acid.

Experiments made with wood alcohol, show similar results. I here give results of two such experiments, the proportion of alcohol to fat being 10 c. c. to 1 gramme.

Sample.	Fat dissolved by 10 c. c.	Temperature.	c. c. $\frac{n}{10}$ K H O required to neutralize 50 c. c. distillate from $2\frac{1}{2}$ grammes.		
			Butter fat.	Undissolved fat.	Dissolved fat.
1	0.225	75°F.	$15\frac{6}{10}$	$9\frac{6}{10}$	$23\frac{1}{3}$
2	0.218	75°F.	$10\frac{1}{2}$	$9\frac{24}{100}$	$22\frac{9}{10}$

The second sample of butter was the same as mentioned above, and was ten months old.

From the above work it is very evident that the portion of fat dissolved by methyl or ethyl alcohol is rich in volatile fat acids. We conclude, therefore, that while the glycerides of the volatile fat acids are present in butter, in such a condition as not to be readily dissolved by alcohol, yet a part of them yields to the solvent action of this re-agent more readily than some of the other fats of the butter. This excess of volatile fat acids in the fat dissolved by alcohol is not due simply to the solvent action of alcohol upon any free fat acid which may be present, as my method of experimenting eliminated this possibility.

Hübl's iodine test also shows that the composition of fat dissolved by alcohol differs from the portion undissolved.

In the following tests the fat was dissolved in wood alcohol of sp. gr. 0.8170 at 60° F. The proportion of alcohol used was 10 c. c. to one gramme of fat:

SAMPLE.	Fat dissolved by 10 c. c.	Temperature.	Iodine number of fat.	Iodine number of dissolved fat.	Iodine number of undissolved fat.
	Grammes.				
1,	0.225	75° F.	37	$33\frac{76}{100}$	$38\frac{3}{10}$
2,	....	....	....	$34\frac{6}{10}$	$37\frac{1}{2}$
3,	0.218	....	$45\frac{3}{10}$	$43\frac{7}{10}$	$45\frac{4}{10}$

Below are two determinations of the iodine numbers when ethyl alcohol 90 per cent C_2H_6O was used to dissolve the fat:

SAMPLE.	Fat dissolved by 10 c. c.	Temperature.	Iodine number of fat.	Iodine number of dissolved fat.	Iodine number of undissolved fat.
	Grammes.				
1,	0.126	....	$40\frac{46}{100}$	$37\frac{1}{10}$	$42\frac{2}{10}$
2,	0.1197	82° F.	$41\frac{7}{10}$	$36\frac{8}{10}$	$42\frac{3}{10}$

The fat dissolved by alcohol has a very low melting point, remaining liquid at all ordinary temperatures, while the undissolved portion has a melting point higher than pure butter fat. In one case the undissolved portion had a melting point of 106° F.

An attempt was made to determine the character of the fat acid condensed in condenser during distillation, with the following result:

The fat acid collected in condenser was dissolved in neutral alcohol and titrated with $\frac{n}{10}$ baric hydrate; this formed a heavy precipitate.

Weight of Ba. salt thus formed = 0.1325 grammes.

Weight of Ba SO_4 produced from this salt = 0.063 grammes.

Weight of $Ba SO_4$ which would correspond to 0.1325 grammes of $Ba (C_{10} H_{19} O_2)_2 = 0.0644$.

The melting point of the fat acid collected in condenser was twice determined, and in one case was found to be 80° F. and in the second case 86° F. The last melting point corresponds to that of capric acid. From the above results I judge that the fat acid collected in condenser is composed mostly of capric acid.

Before concluding this article I wish to say that in my opinion the standard of 12½ c. c. $\frac{n}{10}$ K H O, as frequently adopted for Reichert's method, will need some modification. While fresh butter will give results as high as this standard or exceeding it, I believe that in case of butters that have been kept for some time we may obtain results short of this. At least this has been my experience with butter made at my home in the fall and kept over winter, although the butter was still very palatable.

REPORTS OF COMMITTEES.

THE REPORT OF THE COMMITTEE ON USEFUL BIRDS.

By C. C. MUSSELMAN, *Chairman.*

Reports on agricultural topics, such as fertilizers, dairy, apiary, fruit culture, &c., make the work upon such subjects comparatively easy, as agricultural periodicals are full of information on these topics; but the subject of birds, or ornithology, is rarely mentioned in connection with agriculture. Therefore your committee can only give a few practical observations and suggestions in comparison to the importance of the subject.

Birds are universally favored, and insects are as universally despised, especially by farmers. Hence, popular feeling is all on the side of what are often called our "feathered friends." We will consider the question briefly and see how far this statement is warranted by the facts.

We have divided birds into three classes: Those which are fruit or seed-eating, those having a mixed diet, and those which are purely insect-eating. Those of the first class, viz: fruit or seed-eating birds, are evidently injurious to man by what they take from the fruits of his labors. At best, they can be but neutral agents in our service. It is a mistaken idea to suppose that birds can so change their habits as to discard the diet for which their structure has fitted them. A purely granivorous bird cannot be converted into a purely carnivorous or insectivorous one without changing its structure and nature, notwithstanding all that can truthfully be said in favor of such birds.

The English sparrow is an example of this class. It was imported into this country with the hope, or belief, that it would rid our trees of their caterpillars. But that blundering experiment has resulted in introducing a very dangerous element, which has already done great harm, and is likely to do us till more. We now have two nuisances instead of one, for the sparrows are true graniverous birds, helping themselves to grain, small fruits, and sometimes even the buds of fruit trees when driven by hunger, scarcely touching insects of any kind.

English sparrows are increasing to an alarming extent. Useful and

beautiful species, such as the martin, swallow, blue bird, wren, yellow bird, bobolink, robin, peewee, "tomtit," &c., are driven away by this pugnacious little intruder, that has neither beauty, nor does he seem to understand the first principles of vocal music, verily with nothing to recommend him.

The English sparrow is no longer confined to cities and towns, but is spreading over the whole country, and if not arrested in its progress, it will become a pest to the United States, as much so as the locusts mentioned in holy writ, were to Egypt. Your committee have been instrumental in procuring the passage of an act of Assembly, making the English sparrow free game, and that act alone, were nothing else contained in this report, should weigh much in our favor.

With the second class of birds, those living on a mixed diet, we are comparatively litttle concerned, since they are very uncertain in their habits as to diet. The common blackbird and crow are examples of this kind, beneficial at one time and injurious at another. But from all the observations and evidence at hand, your committee is inclined to give this class of birds "the benefit of the doubt," and render a verdict of *not guilty*.

The third class is the one whose claims we need to investigate more closely. At first sight it would seem that all insectivorous birds are useful, but this assumes that all insects are injurious, which is entirely erroneous. For, considering the habits of insects, they can, like the birds, be regarded under three classes, the beneficial, the harmless and the injurious. The first class we should favor and encourage, their service to us is incalculable, since by their structure and mode of life, they will do for us what we can but imperfectly perform ourselves. They are among our best friends.

To the second class of insects we may be indifferent, they are neither a benefit nor an injury. Among the third class are our great tormentors. Now, the question is not, do birds eat insects, but do birds discriminate between injurious and beneficial insects? What birds to kill, and what birds to protect, are questions that your committee is not able to answer in this short report.

The destruction of a number of our most useful species of birds is going on at a most alarming rate. The country is made bleak and cold by the destruction of the forest, the natural shelter and abode of the birds. Many birds are destroyed, during the breeding season, such as the meadow-lark, "tomtit," starling, and other species that hatch on the ground, by fire, farm implements and machinery. But it remains for wicked and thoughtless men and boys to destroy by wholesale their most innocent and best friends—the birds. Some do it for sport, some do it simply to gratify an evil propensity to kill, others do it for the lust of gain. They kill everything that wears feathers to satisfy the demands of fashion and its votaries.

Although it is impossible to give the exact number of birds killed each year, some figures have been published which give an idea of what the slaughter of innocent birds must be. A single local taxidermist handles 30,000 bird skins in one year, and a single collector brought back from a three months' trip 11,000 skins, and from one small district on Long Island about 70,000 birds were brought to New York in four months time. In New York one firm had on hand February 1, 1886, 200,000 bird skins. The supply is not limited to home consumption. American bird skins are sent abroad. The great European

markets draw their supplies from all over the world. In London there were sold in three months from one auction room 404,464 West India and Brazilian bird skins, and 356,389 East India birds. In Paris 100,000 African birds have been sold by one dealer in one year. One New York firm recently had a contract to supply 40,000 skins of African birds to one Paris firm.

These figures tell their own story, but it is a story which might be known even without these figures. We may read plainly enough in the silent forests and hedges, once vocal with the morning songs of birds, and in the deserted fields, where once their bright plumage flashed in the sunlight.

This cruel and wanton destruction of bird life if continued will not only deprive us of the most attractive features of rural life, but it will surely work a vast amount of harm to the farmers, by removing one of the most efficient checks on hurtful insects.

The food of our small birds consists largely of insects which feed on plants grown by farmers. And insects multiply with such astounding rapidity that a single pair, in the course of one season, may become the progenitors of several billions of their kind. All through the season at which this insect life is most active, the birds are constantly at work destroying for their young, and for themselves, tens of thousands of hurtful creatures, which, but for them, would swarm upon the farmers' crops and lessen the results of their labors.

Birds have wonderful appetites, and the insect-eaters do great execution among the enemies of the agriculturist. This is illustrated by Prof. Woods' estimate that a man would have to consume, in each twenty-four hours, sixty-seven feet of a sausage nine inches in circumference in order to eat as much in proportion to his bulk as the redbreast, whose daily food is considered as equivalent to an earthworm fourteen feet long.

A painstaking naturalist, not very long ago, who watched the nest of a pair of martins for sixteen hours, from 4 A. M. till 8 P. M., just to see how many visits the parent birds made to their young. He found that in that time three hundred and twelve visits to the four young were made; one hundred and nineteen by the male and one hundred and ninety-three by the female. If we suppose only six insects to have been brought at each visit, this pair of birds would have destroyed, for their young alone in this one summer day, not far from two thousand insects.

The important relations which our birds bear to agricultural interests is justly recognized by all State governments. Laws have been enacted for the protection of birds, but these laws are constantly violated by the lack of an intelligent public sentiment to support them. These laws are nowhere enforced. Is it not time that we call a halt to this wanton destruction of our best friends, the birds?

Birds are killed by the thousand; yes, by the hundred thousand, for millinery purposes; even the innocent and beautiful humming birds are not spared, and so long as fashion demands feathers, birds will be slaughtered. If this enormous destruction of birds can be put in its true light, interest aroused, sentiment created, perhaps a stringent law passed and enforced, not until then will this great wrong cease.

All true women should prefer birds as live pets rather than dead ornaments.

"There is an element of savagery in the use of birds for personal decoration which is in grotesque contrast with our boast of civiliza-

tion," says Henry C. Potter, "even the savage is outdone in this craze for feathers. Only Christian people will butcher and wear a whole bird on their heads for ornament." "If there were no purchasers, there would be no demand, and as women principally create this demand, it rests upon them to stay the cruelty of this slaughter of the innocents to gratify fashion."

John Burroughs says, "It is a barbarous taste which prompts our women and girls to appear upon the streets with their head dress adorned with the scalps of our songsters." John G. Whittier says, "We are in a fair way to destroy both our forests and birds. I could almost wish that the shooter of birds, the taxidermist who prepare their skins, and the fashionable wearer of their feathers might share the penalty which was visited upon the ancient mariner who shot the Albatross."

Perhaps the greatest agent now in our country for the correction of this great wrong, to ourselves and our feathered friends, we have in the "Audubon Society," for the protection of birds, organized in New York, in February, 1886. A society not quite one year old, yet it has a membership of about seventeen thousand, distributed in local societies all over this great country of ours. It is named after John James Audubon, the great naturalist and ornithologist.

In conclusion, your committee join in the hope that all true patriots and advocates of the right, the useful and the noble will aid in the protection of our feathered friends, the denizens of the air, for the promotion of our mutual good, our comfort and our happiness.

C. C. MUSSELMAN, *Chairman*,
M. W. OLIVER,
EASTBURN REEDER,
B. H. WARREN,
WM. S. ROLAND,
GABL. HIESTER,
J. P. BARNES.

REPORT OF COMMITTEE ON FRUIT AND FRUIT CULTURE.

G. HIESTER, *Harrisburg, Pa., Chairman.*

The year 1887 has been decidedly an off year for fruit in Southern and Eastern Pennsylvania; in the northern tier of counties they had a full crop. The growers all over the State were much encouraged by the bountiful crops of last year and were led to hope for at least a partial repetition of the same by the fine condition in which all plantations passed the winter.

Strawberries, raspberries and blackberries looked unusually well early in the spring and put forth a luxuriant growth of foliage, but the continued wet weather in some sections and severe drought in others at the time of inflorescence prevented proper fertilization, and the result was the lightest crop we have had for years. Even this was reduced fully one-half in some sections (notably Dauphin county) by heavy rains during the picking season, which softened the berries and rendered them unfit for market.

Peaches were almost a total failure so far as reported to us, except in Clinton, Crawford, Bradford, Wyoming, Lackawanna, Sullivan, Warren and Lycoming counties, where they had a full crop; also a few

orchards in York county that were favorably located and had the fruit carefully thinned last year. Many plantations were entirely ruined by last year's heavy crop, supplemented by the ravages of the borer, and are now in such a low condition that they will hardly recover.

The yield of plums, except in Bradford county, was not sufficient for the needs of the curculio. They took possession of the entire crop, and the overflow attacked the pears and the few peaches that they could find.

Pears promised well; the trees as a rule set all the fruit they could bear, but the unusual number of insects which, owing to the scarcity of other fruit, were forced to devote all their energies to the pear, spoiled the crop entirely. Fully one-half of the pears were stung by the codling moth or the curculio, or both, and either dropped when half grown or else remained on the tree, knotted and gnarled until picking time, when they were hardly worth gathering. The only exception to this so far reported are the counties named above, where they had very few insects and a full crop of pears and apples. The latter fruit bore such an abundant crop last year in the Eastern counties of the State that no one expected a great yield this fall, but some young orchards and trees that failed to bear last year were well laden, and the codling moth appears to have found them all. It is very difficult to find a sound apple south of Crawford county.

The member of the committee from Lancaster county says their best crop this year was insects, the caterpillar yielding a full second crop and others doing proportionately well.

Grapes set a full crop, but owing to the ravages of insects, some of which stung the grapes while others attacked the foliage, the clusters were not so perfect and the crop not so large as usual, except in the Northern tier of counties. Of the newer varieties Moore's Early appears to be growing in favor. This year it bore well wherever heard from; the clusters are large and compact, grapes large and covered with a beautiful bloom, and do not drop off so readily as most early varieties. It is the handsomest dark grape in the market, and ripening, as it does, about two weeks before the Concord, commands a good price. Niagara rotted badly in some places; Worden rotted rather worse than usual. Attlio mildew and black rot are reported not so bad generally as last year.

From the above it will be readily seen that the fruit crop in Pennsylvania this year did not yield much profit or pleasure to the grower. But in the opinion of your committee he has no reason to be disheartened; such a failure seldom occurs except in a year following one of great plenty, and we have the evidence all around us of better times next year.

The new planted strawberries never looked better than now; the frequent rains have kept them growing all through the season, and the well-matted rows give promise of a bountiful crop next year. Raspberries, blackberries and grapes made an unusually heavy growth of well-ripened wood. The new planted orchards have taken a good start, and the older ones show by their thrifty appearance that they have made good use of their season of rest.

So we say to all fruit growers, don't waste your time bemoaning the failure of this year's crops, but devote all your energies to the task of putting your plantations in proper shape to stand the winter. Dig out every borer from your peach trees and bank up well about the trunks

with earth, arrange for the proper drainage of your land so that no water may lay about the roots of your trees and vines, remove all bunches of weeds and grass that would form a harbor for mice, and during the winter collect a good supply of manure to feed them when they first put out their leaves in the spring. Do well your part, and rest assured that this season's failure will not be repeated next year.

REPORT OF COMMITTEE ON FARM IMPLEMENTS AND MACHINERY.

By ISRAEL GARRETSON, *Chairman.*

Every year increases the necessity for substituting horse and steam power for hand labor. The superior cheapness of horse power is shown by the simple estimate that while the strength of an active man is only one-fifth that of a horse, the cost of the latter, as usually kept by farmers, is but a little more than one-third; in other words, a horse will accomplish any heavy labor that he can perform at about one-twelfth the cost of employing men to do the same. This estimate will of course vary with localities and circumstances, but is a fair approximate average, and shows the importance of applying this cheap strength by means of farm implements and machinery to every possible operation. The use of steam power is becoming rapidly introduced throughout the State of Pennsylvania for threshing, and at no distant day will be used in many localities to give power to turn the soil.

Farm implements and machinery are so near one and the same thing that it will be a task to separate them.

For instance, we will take the sickle, which implement was in general use forty years ago, and now we use reapers and binders drawn by horses.

Thus we have machines taking place of implements.

In the first place, we will caution every farmer to be careful in making investments in farm implements and machinery. He may soon invest large sums of money, and have all our spare roof room crowded with implements and machines that are of little or no value to us. In selecting farm implements and machines, too great care cannot be exercised to select the very best the market will afford, and be sure you purchase those only that are adapted to your wants.

We find plows of different patterns adapted to the turning of any kind of soil, that will challenge the ingenuity of the most shrewd inventor to make any improvement. Within the last few years there has been great improvements on corn plows that facilitate the labor of keeping the ground free from weeds and loosen the soil so as to retain moisture, which has been of immense value to the Pennsylvania farmer.

Harrows have received a large share of the attention of the inventor. Amongst the large number of different kinds is the spring tooth; it is generally conceded to have trebled the efficiency of a team in preparing the ground either newly cleared or old for a crop, or in putting in the same—that is, a team will do as much in one day with the spring-tooth harrow as they would in three with the old spike-toothed harrow, and at the same time leave the ground in better order.

We are in want of a spike-tooth harrow to break the crust that may have been formed by a beating rain immediately after the seed has been

placed in the earth. Many crops have been seriously damaged in this manner; the tender plants, not being strong enough to break through the crust, are doomed to perish, much to the chagrin of the anxious farmer. Had the earth been slightly broken, time would bring a plenteous crop. Right here in place will be proper to speak of the field roller. The farmer cannot afford not to have this implement, or something that will fill its place to some extent. After using the harrow, we want the lumps broken and the fine earth settled, so as to retain moisture for the growing crop.

The mower, reaper, horse-rake, binders, grain drills, hay elevators have taken their places in due time to lighten farm labor and add millions of dollars to the nation's wealth in the way of hastening its progress, in preventing over-ripening or in escaping storms.

We consider the grain cutter and binder one of the best of inventions. There is great room for improvement in the complication of gearing and weight of the machine.

We have no statistics to show the actual number of mowing machines, reapers, binding machines, horse-rakes, horse-forks, threshing machines, planting machines, &c., in present use; but it is not difficult to make an estimate of the advantages to be derived from their general introduction.

We are glad to say some of our farming implements and machinery, including mowers, reapers, binders, grain drills, hay rakes, plows and harrows can be purchased at greatly reduced prices from former rates, coming somewhere near their real cost of construction, thereby enabling the ordinary farmer to be benefited by their use. There are still some of the newer implements on which too much royalty is paid to the patentee or the manufacturer. The fodder cutter and crusher is an implement that should be in more general use, thereby saving feed and making better manure.

Windmills for the pumping and distribution of water should be in far more general use.

The general use of commercial fertilizers has stimulated the manufacturer of fertilizing grain drills and other fertilizer distributing machines, so that we now have some complete machines of this class at a satisfactory price. We hope the time will come that a desirable machine might be made to reduce coarser manures to a condition to be used in these drills.

In conclusion, we would say that nothing contributed more to disseminate correct information on the merits of machines than agricultural fairs and such exhibitions as that held at Williams' Grove, where our people can learn of the great and constant improvements being made in farm implements and machinery, and where competition serves to reduce the price to a reasonable sum. We discourage the use of very high-priced and complicated machinery that is likely to get out of repair, and which requires a skilled mechanic to work it successfully, so long as the market prices of our products are so low as not to warrant the expenditure. Great care and economy must now be used to make "credit" meet "debtor" in farming.

ISRAEL GARRETSON,
C. C. MUSSELMANN,
M. W. OLIVER,
N. F. UNDERWOOD,
J. A. HERR,
CHANDLEE EVES.

REPORT OF COMMITTEE ON SILK AND SILK CULTURE.

Dr. J. P. BARNES, *Allentown, Pa., Chairman.*

Silk culture, though practically so little is done in the United States, where the consumption of the raw material is now becoming so great, is not a new project even in this country, and quite an ancient employment in the old world.

We learn from sacred history (1715 B. C.) that when King Pharoah set Joseph over his house and over the land of Egypt, that he arrayed him in vestures of fine linen, &c., which in the margin reference is rendered silk.

In Proverbs, chapter thirty-one, verse twenty-second, which refers to the praise and properties of a good wife, 1015 B. C. it says, "She maketh herself coverings of tapestry, her clothing is silk and purple," Ezekiel sixteenth chapter, tenth verse, where reference is made to Jerusalem in the similitude of a person, the Prophet says: "I clothed thee also with broidered work and shod thee with badger's skin, and I girded thee about with fine linen and I covered thee with silk," thirteenth verse, "and thy raiment was of fine linen and silk and broidered work," 594 B. C. These few references show that even at that time, the inhabitants of the old world knew of the silk worm product and had the art of converting it into fabrics for wearing apparel.

A writer on this subject says: "The Greeks knew the silk people as 'Seres'—there is much dispute as to the real origin of the name—and called the product 'Serikon,' whence, through the latin 'Sericum' and an intermediate form 'Selic' comes our work silk."

In Rome, "silk, there worth its weight in gold," was a mark of effeminate luxury.

"Heliogabalus" crowned his extravagance with a silken robe, and would have ended it with a silken rope he had prepared for that purpose, had not his murderers forestalled him.

"Aurelian" refused his empress a silk dress.

Silk culture was introduced into Europe by the help of two grateful Nestorian monks, who traversed Asia with silk worm eggs hidden in their hollow pilgrim staffs, and a thorough knowledge of the industry stored in their heads.

Silk weaving in Western Europe dates from the Saracean conquests, but the return of King Robert of Sicily, from the second crusade in 1146 with captive silk weavers from Greece, gave it a new impetus.

Henry of Navarre, who about 1603, taking a hint from the book "Olevierde Seres," the father of agriculture, really made France the great silk country it now is. His minister, "Sully," opposed him and scoffed at the silk merchants of Paris, who came before the King in quaint garb ornamented with various silks. Sully argued that luxury should be repressed.

At first the experiments, which the king urged his subjects to make, failed, and the people petulently destroyed trees and worms. But Henry persevered, shamed his subjects by turning a great orange grove, one of his ancestral estates, into a prosperous silk farm.

The revocation in 1685 of his edict of Nantes nearly annihilated the industry for a time. Lyons, which had 18,000 looms, could not find weavers for 4,000.

The 11,000 looms of Tours were reduced to 1,200, and her 800 mills to 70, and the 100,000 Huguenots, who fled to England, made possible a thriving silk industry there.

King James I. had, however, taken a hand at the industry long before this, in the hope that the culture of silk would help him to root out tobacco. Had he succeeded in doing this a great and growing pernicious habit might have been nipped in the bud. But it was manufacture rather than the production of raw silk that was to succeed in England and America.

In the new world silk culture had been a plan of Spaniards for Mexico. Immediately after its discovery, Cortez, in his scheme of government for New Spain, 1522, included officers to oversee silk-growing. Silk-worm eggs were sent from Spain.

Some export of raw silk is recorded, and woven silk goods were made in and exported from Mexico, but the industry did not outlive the century.

When King James' plan for silk making in England was prominent in his mind he began also to look to his colonies for a supply of silk, and most of the schemes for developing Virginia included silk culture. In 1622 one John Bomœl was sent over to Virginia as instructor in silk culture, and with him went the most peremptory instructions for the compulsion of any person found either through negligence or wilfullness to omit planting of vines or mulberry trees. Twenty pounds of tobacco was made by the Legislature the penalty of neglect, and a premium of fifty pounds of tobacco was offered for every pound of reeled silk produced. There is a tradition that King Charles II. wore a robe and hose of silk from Virginia at his coronation in 1660.

But even the bounties were not effective, and silk culture in Virginia died with the century.

While silk culture was waning in Virginia, new efforts were made further south. Some of the French Huguenots came to the Carolinas and wove a wool silk mixture. At that time the use of the negro slaves for silk growing was urged.

An act of parliament in 1749 declared that Georgia and South Carolina should have the honor of being denominated silk colonies.

Shortly before the Revolution there was a renewal of the silk fever, chiefly in the northern colonies of Pennsylvania and Connecticut.

Benjamin Franklin, writing from London in 1770, induced the American Philosophical Society of Philadelphia to take steps to start a public filature, which was opened in June of that year.

In 1776, the United Society for Promoting American Manufactures, of Philadelphia, recommended a bounty of forty pounds to John Marshall for improved machinery for twisting silk. But the war came, the colonists had their hands full with fighting and raising breadstuffs, and the silk industry was suspended.

It was not altogether dead. Silk making revived literally as a household industry. The women and children of Connecticut families raised from five to as much as one hundred and thirty pounds of silk, and the production of Mansfield town from 1820 to 1831 reached fifty thousand dollars a year.

The year 1826 marked the origin of the *morus multicaulus mania*, which raged as a fever from 1830 until it culminated and collapsed in 1839.

The whole country went wild. The fever seemed only to get fresh fuel of the excitement. From the panic of 1837 orchards of the *multi-*

caulus were planted in every State. Farmers everywhere set their wives and children to feeding worms. Even your humble servant tried his hand at raising and feeding worms at that time. This gigantic enterprise produced multitudinous books. Public documents, periodicals on silk culture, constituted the bulk of the reading of the day.

The speculation in twigs and trees ran wild. In 1838, offerings at one dollar per tree or twig were refused, and five dollars were sometimes got for trees one year old.

In 1839 the bubble burst, and many a speculator was caught with his stock on hand, with no further market for the same, and in some localties they were worth only a part of one cent for pea brush.

After this extraordinary period very little was done in the way of silk culture until the year 1880, at which time the Women's Silk Culture Association of Philadelphia, on the first of May, at No. 1328 Chestnut street, opened rooms for the purpose of a school of instruction in the art of silk culture, to teach the methods of feeding, rearing, propagating silk worms, and collecting cocoons and floss silk for the market, hoping thereby to induce our farmers and small lot-holders to set out mulberry trees, propagate worms, and produce cocoons. It was thought such an industry was greatly needed, even in this State, to give employment to the women and children of the needy; to prevent our farmers and others from emigrating away from among us.

The association desires to offer to the State agricultural schools, institutions and reformatories, or to individuals who may have a purpose or desire to establish the culture of silk, a gratuity in mulberry trees in lots not less than twenty-five nor more than one hundred. In every instance a guarantee must be given, signed by two vouchers, that the recipient who may accept these trees shall give them the proper attention required for their full fruition.

This industry consists of ladies who appear determined to make it a success if by their indomitable efforts it can be done. Struggling up to 1885 and 1886 for want of funds, after repeated appeals to the Congress of the United States for an appropriation, $5,000 was granted, and at the close of the seventh year of their work they were again honored with the confidence of the National Government by the appropriation of $5,000, to be used in the direct interest of the industry.

This action of the United States Government has enabled the association of women to ply their efforts without being compelled to make constant calls upon the public for support as heretofore. Through the kindness of Mrs. I. Lucas, president of said association, I have been furnished with printed statements, giving the value of cocoons, the amount produced in twenty States of our Union, and purchased by the Women's Silk Culture Association from October 18, 1886, to January 5, 1887, Ohio and Illinois having furnished by far the greatest quantity. A summary of the detailed statement gives the following as to each State enumerated:

Massachusetts,	4	pounds	6	ounces,	for which was paid,	$3 41
New York,	3	"	5	"	"	2 81
New Jersey,	8	"	8½	"	"	8 14
Pennsylvania,	54	"	4¼	"	"	40 55
Virginia,	60	"	10½	"	"	42 80
West Virginia,	3	"	0	"	"	3 38
North Carolina,	95	"	7	"	"	49 36
South Carolina,	9	"	4	"	"	4 77
Georgia,	18	"	6½	"	"	11 38
Florida,	56	"	2¼	"	"	52 24

Alabama,	1 pound	12 ounces,	for which was paid,	$0 70
Mississippi,	3 "	10	" "	1 27
Louisiana,	9 "	6¼	" "	8 72
Texas,	11 "	12½	" "	6 99
Arkansas,	30 "	1½	" "	15 40
Tennessee,	37 "	0	" "	13 56
Kentucky,	67 "	10	" "	38 80
Ohio,	1,063 "	11	" "	780 13
Michigan,	241 "	12	" "	238 18
Indiana,	140 "	13	" "	100 80
Iowa,	165 "	2	" "	111 68
Illinois,	780 "	2	" "	622 33
Missouri,	267 "	13	" "	194 45
Kansas,	596 "	7	" "	351 85
Nebraska,	71 "	3	" "	32 18

Apportioned as follows: Reelable, 2,108 pounds one ounce. Pierced, one hundred and twenty-seven pounds five ounces. Waste, nine hundred and one pounds four and one half ounces. Value, $2,408 71. Expense, $137 75. Net paid, $2,270 96.

The association pays for cocoons as follows: For cocoons yielding on the reel.

4 ounces of silk to one pound of cocoons, sixteen ounces to pound,	$1 15
3½ " " " " " " " " " " " "	1 00
3 " " " " " " " " " " " "	85
2½ " " " " " " " " " " " "	70

Below this quality cocoons are only fit for waste, and even then are not desirable, as they contain the chrysalis, which renders them troublesome to the manufacturer.

Good pierced cocoons, as waste, per pound,	60 to 70 cts.
Poor whole " " " " "	35 to 40 cts.

Cocoons yielding over four ounces to the pound a special price will be given.

I quote the following as stated by the Women's Silk Culture Association:

"The value of the work of instruction and encouragement to silk growers can only be understood by the detailed statement in which the weight of each separate lot of cocoons is given, with actual payment made for it by the Women's Silk Culture Association. The entire quantity of cocoons (dry weight) so received up to December, was 3,136½ pounds (equivalent to 6,500 pounds in the green state, as weighed and sold in Europe), of which 2,108 pounds were reelable, 127½ pounds pierced, and 901¼ pounds imperfect, or in some way injured, most of them by bad handling. The sum of $2,408 71 was actually paid these growers, an average of seventy-seven cents per sixteen ounces for the whole; and of ninety-three cents per pound for the reelable cocoons. If all these cocoons could be reeled promptly, as most of those in Italy are, or as soon as possible after being gathered, the crop would be far more valuable. It is already apparent that many districts in Ohio, Michigan and Illinois particularly, could maintain local filatures and produce large quantities of the best reeled silk, which, when once reeled, would not suffer injury as cocoons do.

"It is certain that many considerable lots of cocoons have been grown in 1886 not reported at all to the Women's Silk Culture Association, some estimates being that one-third of the entire growth is either reeled at home or sold to the mills making spun silk and spool silk, or silk noils yarn for mixtures. There are now four or five large establishments making spun silk and using cocoons, both domestic and foreign. The importation of pierced cocoons is growing rapidly.

In eleven months ending November 30, 1886, the importation was 349,035 pounds, valued at $248,160, being seventy-one cents per pound. There is, therefore, a certain market for cocoons at seventy cents or more per pound, and about 400,000 now imported for the year 1886. The market for cocoons is so large here as to attract them both from Italy and from Japan, which is an assurance that they need not be sent aboard, whatever quantity should be grown here.

"It is evident that the silk growers in Ohio and Illinois will soon find buyers at their own doors, and probably at the hands of silk manufacturers, who establish themselves in those States as they have done so largely in Pennsylvania and New York within the last two years. But a year or two more of such aid as the Women's Silk Culture Association has extended will put the new industry on a firm basis. It is most anxiously desired to effect the same development in the Southern States, or from Maryland southward where the soil and climate are more favorable than in the Western States."

Although the silk culture in this country is slow in progress, the erection of mills for converting raw material into mercantile fabrics is increasing in growing numbers, and spreading in the eastern part of Pennsylvania. As evidence of this fact I will name a few towns that have been brought to my notice where mills or factories have been placed within six or seven years past.

Allentown has two important mills, Bethlehem has three, Easton has one, and, I think, Phillipsburg, N. J. (just opposite to Easton), also has one, Catasauqua has one, Mauch Chunk has one, Reading has one, Wilkes-Barre has one, Scranton has two, Pottstown has one, Pottsville—the Phœnix Manufacturing Co., of Patterson, N. J.—are at present erecting one, Harrisburg has one, Phœnixville has one, Honesdale and Hawley each have a mill. These several factories all, I believe, are in active and full operation, and employ hands varying in number from one hundred and fifty to as many as eight hundred and fifty. The majority do silk throwing. The larger ones do throwing, warping, weave ribbons and broad silk.

The wages of spinners vary from five to six dollars per week, that of warpers from seven to ten dollars per week, that of weavers from nine to fifteen dollars per week. This great industry is developing and growing rapidly in this country, and all the silk factories use imported and raw material. Could this be produced and furnished here in the United States and Territories, what an amount of wealth would be retained which now goes abroad.

It appears that since 1880 our manufactured product has increased from $34,000,000 to over $50,000,000, and that there must have been a corresponding decrease of silk imports.

Could silk culture increase in this country at the same ratio, a corresponding decrease of raw silk imports would follow. We have the soil and the climate for growing mulberry trees with success for hatching silk worm eggs and growing worms, the population to draw from for carrying on the enterprise. Now, the question arises, shall the time come when these United States will become the silk field of at least our own supply?

REPORT OF COMMITTEE ON FORESTS AND FORESTRY.

By HON. WM. GATES, *Oil City, Pa., Chairman.*

It is a well-established fact that the owner of land has the indisputable right to do as he pleases with his premises or possessions, so long as he does not interfere with the rights of others. If he wants to cut the timber growing on his land and use it for needed purposes, or transport it to market, no one can question his right to do so. This Commonwealth was a timbered State when the white race took possesion of it. The best arable lands were the best timbered, and to make homes in the wilderness, much timber that would now be valuable, was cut down, rolled into heaps and burned up. The timber thus destroyed in many instances would now be worth more than the soil, with the improvements thereon. As the arable lands became settled and devoted to agricultural pursuits, towns and cities sprang up and manufacturies were established. Saw mills cut the pine and hemlock into timber, which was floated to any market that could be obtained for it, and the oak was cut into cord wood and chared into coal to supply the iron furnace, previous to the building of railroads. In this State the demand for lumber was limited, the little that was used for manufacturing purposes was of the best quailty. But now there is a large demand for oak lumber. The portable saw mill has invaded every nook and corner of oak timber that can be obtained; the best is cut into staves, the balance into car and bridge timber, ties and wood. Holders of valuable timber have become economic and are manufacturing timber into lumber that was formerly discarded as worthless. The supply of merchantable timber is being rapidly exhausted and the consumption increasing yearly. There is but little pine timber left in this State that will make number one lumber, and the advance in price has increased the consumption of hemlock more than three-fold. The timber we had in this State was wasted and given away for a small consideration, that should have been preserved until it was needed. In addition to our present supply large quantities of lumber have been brought into this State from Michigan, Wisconsin, Canada, and the Southern States. Whereas forty years ago we supplied our own wants, and supplied the Ohio valley and the Susquehanna, and markets east and south therefrom, and it is high time that "we spare that old oak tree," and plant more trees.

The following questions was sent to the members of the forestry committee and other correspondents:

First. How much of the land in your county?

The average report from fifteen counties is thirty-one per cent.

Second. How much of the original growth remains?

The average reply, six per cent.

Third. What is the condition of the original growth?

Fourteen answers declining, one good.

Fourth. What is the condition of the second growth?

Answers unanimously good.

Fifth. What effect has the removal of forests had on rainfall?

The answers to this is, none whatever.

Sixth. What effect has the removal of forests had on springs and streams?

The answers to this question were not unanimous, but a majority agreed to the following conclusion:

That the removal of the forests and clearing of the land for cultivation removes the obstructions to the free exit of the water to its natural course, causing more violent floods which recede with greater rapidity from want of supply to maintain it. In this State we are subject to climatic changes. Rains are local in the summer season. We may have an excess of rain in one part and a drought in another. History tells us that in 1755 there was no rain from April to November, and in 1813 from April 14 to September 20, and at that time this State was covered with trees.

Seventh. What remedy to prevent forest fires?

The answers were: Publish the law and enforce it with severity. The act of 1887 fixes a penalty of fifty dollars for the wilful or careless firing of timber land. One-half to go to the informer and one-half to the school fund of the district. The fine fixed by the act seems objectionable to your committee for the reason that the party damaged receives no compensation. Your committee makes this suggestion that the act of 1887 be amended, making it the duty of the constables of the several townships of the State to investigate the cause of all forest fires, and report the same to the court of quarter sessions, giving the name of the person or persons who set fire to the forest, and whether wilful, malicious or accidental. Railroads should be compelled to have the most approved spark arresters, and secure fire boxes on all locomotives. More fires originate from sparks igniting dead grass and leaves than from any other cause. If forest fires are not permitted to burn a growth of young thrifty timber will soon cover our barren mountain.

Eighth. What should be done to encourage the cultivation of timber?

The answer to this question is: Stimulate the people to observe Arbor Day and plant trees. Too much carelessness and indifference has existed in the preservation of our forests, "but agitation of thought is the beginning of wisdom." Our school children are taught to observe Arbor Day and plant trees, and we now see the monuments they have planted around nearly every school house in the State.

Timber culture and the preservation of our forests has occupied the attention of our far-seeing economists for some years past, and various measures suggested and enactments passed to prevent the destruction of our forests, the last of which was a bill prepared by the Forestry Association to exempt land planted in trees or let grow up again when cut, the greater portion of the taxes, for thirty years. That bill was not approved by your legislative committee, but it was introduced into the House of Representatives and has become a law. That act does not meet the approval of your committee for the reason that this is a natural spontaneous timber growing State, that the land that will be exempted under this act is not susceptable of cultivation and may be valuable mineral lands, and that timber growing would be more profitable in the proportion of taxes and labor than cultivated land, and to relieve land set aside for timber culture from taxes would place heavier burdens of taxation on the tillers of the soil. And it looks to your committee like a "job" in the interest of speculators, who have feathered their nests by cutting and selling their timber and now want it relieved from taxes to grow again. The National Government and the State Governments of the Prairie States have given inducements

to settlers to plant trees. In some of the States forty acres is exempt from taxes by planting and cultivating three acres of trees, and advantage has been taken by may farmers to place all their buildings on the lot that is exempt, and escape nearly all their taxes.

But it is a mistake to suppose that the west and northwest are the only sections which can be benefited by the cultivation of young trees. It is easy to chop down a great oak or pine, but how long to replace those that have been removed. The conversion of forests into lumber is easy and rapid compared with the rehabilitation of our mountain sides after they have once been denuded. The process of destruction has been going on for more than a century, and the work of replacing our magnificent forests has already been delayed too long. Arbor Day had its origin in Nebraska fifteen years ago and the beneficial results are summed up in the fact that seven hundred thousand acres of trees have been planted and growing in that State, which were planted by human hands. Many other States have adopted the custom, and plains and prairies that were treeless a few years ago are now studded by millions. Pennsylvania is not so barren of trees as many other States, but there is room for millions, not only to take the places of those removed by the axe and the grubbing-hoe, but to give grateful shade to man and beast along the highway. All classes of citizens, and especially farmers and suburban residents should make an effort to add something to the general beneficence of Arbor Day.

"A thing of beauty is a joy forever," and there is nothing more beautiful than clumps of trees so situated that the eye can rest upon them, or that their refreshing shadow can be sought and enjoyed. The mere gratification of the senses furnishes an ample incentive to the observance of Arbor Day. But there is an economical as well as an esthetic reason for planting trees, It will pay to repair as far as possible the wastes which have followed in the destruction of our beautiful forests. The coal, gas, iron and oil which we have been consuming so lavishly can never be replaced, but not so with our forests. The trees will grow again if we but take the trouble to plant and care for them, and in no way can one generation confer greater benefits upon another than by adding to the number of trees.

REPORT OF COMMITTEE ON DAIRY AND DAIRY PRODUCTS.

By EASTBURN REEDER, *New Hope, Pa., Chairman.*

The condition of the dairy industry presents a more hopeful aspect than it did a year ago, when our last annual report was submitted. Prices for dairy products have improved, and the demand is good. A year ago we were looking for the decision of the Supreme Court of the State, in the oleomargarine law. That decision was not rendered until the beginning of the present year, and was an almost unanimous decision in favor of the constitutionality of the law ; six in favor, and only one in opposition. The hopes of the dairyman have been encouraged by a slight increase in prices for dairy products, and a better demand. On the other hand, the fears of consumers, that butter would so advance in price as to place it beyond the reach of many, has not been realized. Experience has taught that the dairies of the country are equal to the task of producing the needed amount of but-

ter, at reasonable prices—neither extravagently high, nor ruinously low. Creamery butter in the south-eastern counties of the State, supplying the Philadelphia market, did not fall below twenty cents per pound, and prices have not yet advanced beyond thirty to thirty-five cents. Dairy stock is also advancing in price, giving encouragement to the breeder and grazer as well as to the dairyman. Fresh cows are now averaging fifty dollars a piece by the car load. To command these prices, however, they must be large cows of 1,100 pounds weight. Cows weighing 800 to 900 pounds would not probably average over forty dollars.

We may safely affirm that the sustaining of the anti-oleomargarine law, by the Supreme Court, has been a great boom to the dairy industry, to the agricultural interests of the State, and, consequently, to the whole community.

A letter received from J. B. Habecker, president of the Philadelphia Produce Exchange, in answer to some inquiries made by your committee, contains the following: "I inclose you prices of best creamery butter for 1886 and for 1887 to Oct. 1. The make of butter according to our statistics, comparing Philadelphia and New York receipts, is larger this year than any previous year. Butter that last year was a drug at eight to twelve cents is scarce this year, from the fact that good, sweet dairy butter has been in demand to take the place of oleomargarine. In other years it was neglected for oleomargarine and left to spoil, consequently a large supply of low grade butter. I am not at present prepared to give statistics, but after the meeting of the National Butter, Egg and Cheese convention I will be able to show you conclusively the immense benefit to the dairy interests of the country through the various oleomargarine laws. There is still room for improvement, as the law is not in all places properly enforced. The butter dealers in Philadelphia have enforced the law in that end of the State almost to the letter. I find now that some oleomargarine is being quietly sold. I am informed that in Pittsburgh it is being largely sold, with no attempt at enforcing the law. This matter should receive serious consideration at your meeting."

Returns received from several counties, representing nearly all sections of the State, indicate the present hopeful state of feeling. Crawford county, representing our north-western section, informs us, "That as regards the dairy interests in this part of the State I may say that for the season it has been much more prosperous than for several years. Butter in July ran dow in price to 12½ cents per pound, but it was only for that month; since then it has been on the rise till now it is worth 20 cents. Cheese has been active all the season at good prices, and is now worth 12 to 12½ cents a pound. Dairy cows have brought fair prices, fresh milk cows from $30 to $40. We may say the dairy interest looks hopeful; dairymen are having more faith in their calling; more cows are now being kept; more money is being made; a better class of cows is kept and more attention given to feed. All these things betoken a hopeful future."

Wayne county, in our extreme north-eastern section, sends word as follows: "Prices of fresh cows last spring would average about $32, present prices for fresh cows and springers a little higher, say $35; cows to come on next spring, $20 to $25. Prices for butter have ranged from 16 cents lowest, to 20 cents highest, which are present figures. Some who packed their butter all through the season have sold the whole of it lately at 20 and 22 cents. There are three facto-

ries in this county making butter on the cream-gathering plan. They have all done fairly well, and the average price paid to patrons will be from 17 to 17½ cents per pound; season not yet ended. While prices are low, dairymen are more hopeful than they were a year ago. No cheese made in this county."

Adams county, on our southern border, sends word as follows: "Dry dairy cows are worth from $20 to $30, according to size and quality; fresh cows from $30 to $40. The prices paid by hucksters for butter have been, lowest, 8 cents; highest, 20 cents; average for the year, 14 cents. Prices paid at creamery for milk, lowest, 70 cents; highest, $1 00; average, 85 cents per 100 pounds. The prices for cows are for common cows and not for blooded stock. Present price for butter at country stores, 18 cents per pound. Prices returned for butter sent to Baltimore market, 25 cents per pound."

FERTILIZERS AND THEIR APPLICATION.

FERTILIZER POINTS.

By the SECRETARY.

1. Phosphoric acid exists, in combination with lime, in ordinary commercial fertilizers in three forms, viz: Soluble, reverted or precipitated and insoluble; the *chemical* difference being mainly in the different proportions of lime and acid.

2. In ground bone and raw South Carolina rock it exists in the form known to chemists as "insoluble"; in this form it is not strictly insoluble as all of the phosphoric acid in ground bone will sooner or later become available as plant food.

3. In South Carolina rock, phosphatic guano and apatite this form of phosphoric acid is much better entitled to the name of insoluble, and, unless mechanically divided to a point which at present cannot be reached with profit, is many years (if ever) in becoming available as plant food.

4. By the addition of sulphuric acid ("oil of vitriol") to ground bone or raw rock a portion of the lime combines with the acid and thus leaves the phosphoric acid in combination with a smaller number of atoms of lime, and either in the form of soluble or reverted (precipitated) phosphoric acid.

5. Inasmuch as all soluble phosphoric acid very soon returns to the reverted form after it is applied to the soil, these two forms are considered of equal value as plant food by the chemist; thus in valuations no difference is made between them and they are valued together as "available" acid.

6. In many instances (and possibly in all) either of the two first-named forms of phosphoric acid return to the insoluble form after they have been in the soil for a certain time, hence it may be claimed that mechanical division, if sufficiently fine, will answer the same purpose as the application of sulphuric acid; while this is possibly correct yet it is certain that thus far no mechanical division has been found sufficiently inexpensive to answer the purpose; hence the application of acid is still the best mode of reduction.

7. Of all the elements of a commercial fertilizer phosphoric acid is the least likely to be lost by washing off or through the soil. Drainage water seldom shows the existence of phosphoric acid, and if more has been applied than is needed for the wants of the single crop to which it has been applied, it remains stored up in the soil ready for the succeeding plant growth.

8. Inasmuch as all soils are but the result of the disintegration of rocks, but the action of the air, wind, frost and rain, phosphoric acid is all the time being liberated from the soil by the action of these elements; the ratio of this liberation of course depends very much upon the nature of the rock formation from which it comes and the readiness with which it parts with its acid.

9. Clay lands have the greatest power of absorbing and retaining phosphoric acid and this power decreases in proportion as the sand (silica) increases; the same argument can be applied to all fertilizing elements with equal force.

10. The decay of vegetable matter always furnishes the soil with more or less phosphoric acid and the presence of lime in the soil enables it to retain this supply of acid.

11. Good farm soils vary in their amount of phosphoric acid from 0.03 to 0.16 per cent; a soil nine inches deep with 0.10 per cent. of phosphoric acid would, in reality, contain from 2,500 to 3,500 pounds of phosphoric acid per acre. As no crop can absorb anything like this amount, it follows that it is in a very nearly insoluble condition.

12. Some few kinds of rock (decayed) are capable of parting with their phosphoric acid directly to the roots of the plant, in exactly the same manner as the same roots would obtain it from the unground bone with which they come in contact.

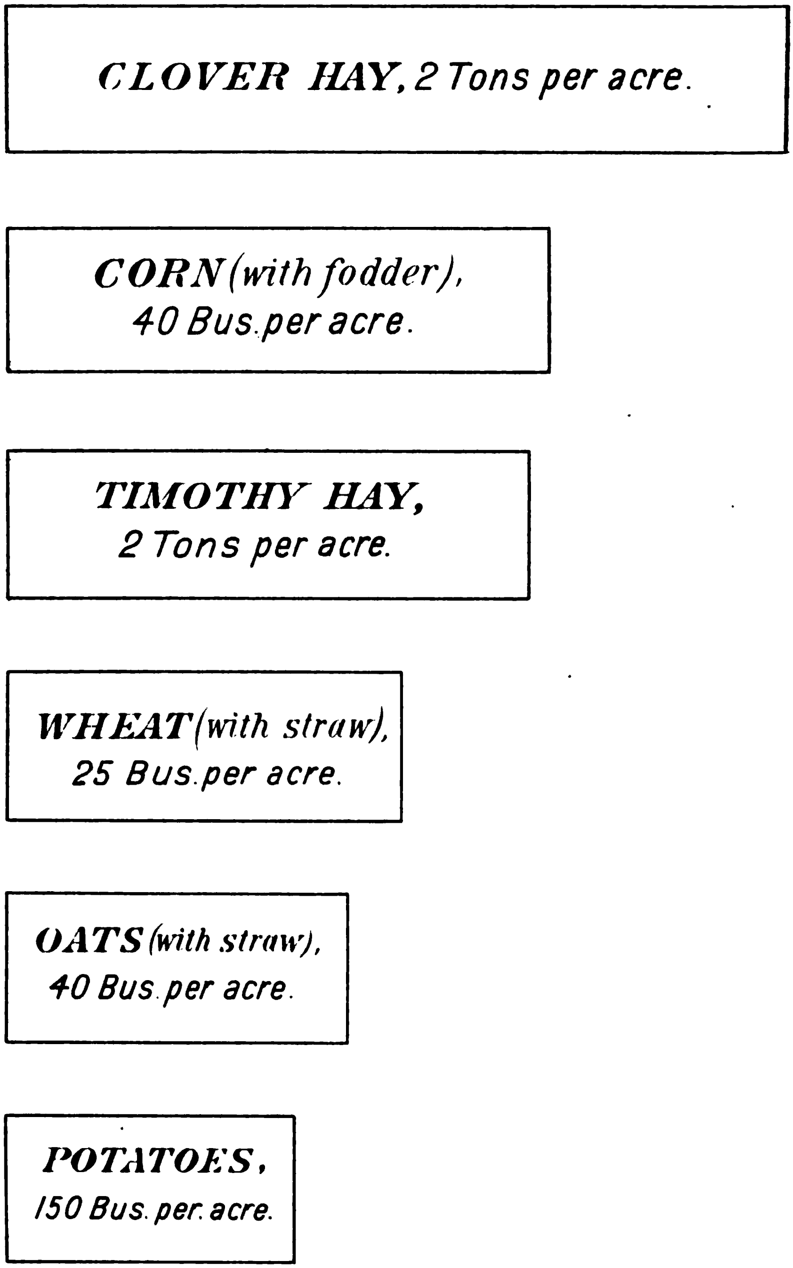
13. In by far the majority of cases, however, the plant has not the power of thus obtaining the phosphoric from the original rock, but in some soils the application of lime adds to or very much increases this power and produces very much the same effects as does the direct application of South Carolina rock.

14. The report of the Connecticut Experiment station thus defines insoluble phosphoric acid: "Insoluble phosphoric acid implies various phosphates not freely soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be readily available as plant food. This is true of the South Carolina rock phosphate, of Navassa phosphate, and especially of Canadian apatite. The phosphate of coarse raw bones is at first nearly insoluble in this sense, because of the animal matter of the bones which envelopes it; but when the latter decays in the soil the phosphate remains in essentially the 'reverted' form."

15. Bone dust made from boiled bones is more liable to be adulterated with "salt cake" than that of raw bones, from the fact that boiling fills the pores with water, and to prevent early decomposition it is often necessary to resort to a somewhat expensive plan of drying the product or of mixing salt cake with it to prevent decomposition.

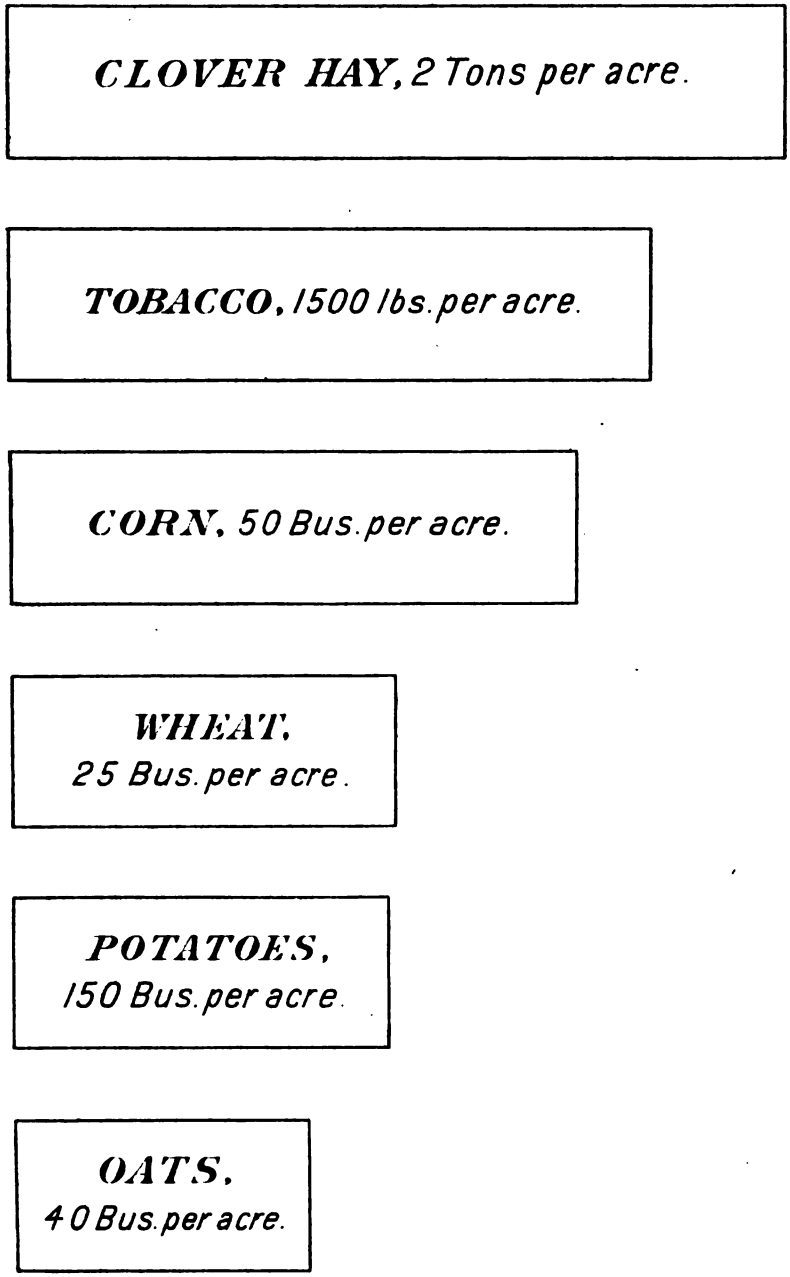
16. If perfectly pure, the dust from boiled bone has some advantages over that of raw bone. It is more readily made available by decomposition. If dry, it has lost a portion of its weight, which can be more economically made up by the use of other materials.

17. In the treatment of ground South Carolina rock with sulphuric acid, the maximum amount of phosphoric acid which may be made available, and still have the mixture in a proper mechanical condition



COMPARATIVE EXHAUSTION OF NITROGEN.

The whole crop being removed.



COMPARATIVE EXHAUSTION OF NITROGEN.

The straw & fodder being returned to the soil.

for use, is about seventeen per cent. For every pound of the phosphoric acid made soluble there is formed by reversion two pounds of sulphate of lime or gypsum, and unless some economical plan can be devised to remove this increasing percentage of gypsum, no higher grade need be expected.

18. By English patented processes, which involve precipitation and "washing," this plaster is taken out, and a much higher per cent. of available phosphoric acid is obtained. The English farmer is willing to pay a fair price for an article which will show forty-five per cent. of available acid, but past experience would seem to prove that his American brother will not pay the price necessary to warrant the increase in expense, although by the process he may be offered an article which will give him available phosphoric acid at a lower rate *per pound.*

19. In the purchase of this class of fertilizers (acidulated South Carolina rocks) the purchaser should have reference to the price paid *per pound* for actual available material, and not to the price per ton.

20. Assuming that refuse bone-black, ground bone and South Carolina rock are the leading sources of fertilizer's supplies of phosphoric acid, we may give the following as their comparative prices at wholesale at a given date: Refuse bone-black, $17 50; ground bone, $29 50, and ground South Carolina rock (without acid), $8 50, all delivered at the same point.

21. The report of the Connecticut Experiment station states that "If we assume that soluble, reverted and insoluble phosphoric acid have *commercial* values (to be distinguished from agricultural value), which stand in the ratio of 9, 8 and 2, then the retail cost per pound of phosphoric acid in plain phosphates bought direct from New York and Philadelphia manufacturers, as shown by the analyses of the New Jersey station, has been as follows: In superphosphates from bone-black, bone-ash, &c., soluble, 7.8 cents; reverted, 6.9 cents; insoluble, 1.7 cents; in superphosphates from South Carolina and other mineral phosphates, 8.6 cents; reverted, 7.6 cents, and insoluble 1.9 cents."

22. In computing the commercial value of a fertilizer, South Carolina rock (acidulated) is usually taken as the basis. Thus, when an article of dissolved South Carolina rock can be obtained on the market for $16 50 per ton of a guaranteed analysis of sixteen and one-half per cent. of available, we may assume that its available phosphoric acid costs the purchaser five cents per pound. If without any reduction in price the guarantee is reduced to fourteen per cent., the price per pound rises to over five and one-half cents per pound.

23. To illustrate this matter still further—in the present condition of the fertilizer market an article guaranteed to fifteen per cent. will cost $19 00 per ton; one with a guarantee of forty per cent. will cost, at the same point, $34 00 per ton; in the first case the available phosphoric acid costs the purchaser 6.33 cents per pound and in the case of the high grade its cost is but 4.24 cents per pound; this is in addition to the saving in freight and handling.

24. The main difference between the (so-called) phosphatic guanos and the ordinary guano of commerce is in the fact that they have been formed in a latitude where the amount of rainfall was sufficient to wash or leach out all of their nitrogen, leaving the phosphoric acid which is thus given a higher percentage that it is entitled to in ordinary guanos.

25. There are very few exceptions to the rule that the higher the

grade the cheaper the available phosphoric acid per pound, and the lower the grade the higher its price. In fact this rule holds good with all kinds of fertilizer supplies.

26. The total shipments of South Carolina rock from ports in South Carolina and by rail, during the past ten years, has been as follows:

1877—163,220	1878—210,323	1879—199,365	1880—190,763
1881—266,734	1882—332,077	1883—355,333	1884—309,888
1885—345,865		1886—353,342	

27. In 1884 one of our most careful staticians estimated the total consumption of commercial fertilizers in the United States, as follows:

Alabama,	45,000 tons.	Mississippi,	10,000 tons.
Delaware,	20,000 tons.	New York,	30,000 tons.
Florida,	5,000 tons.	New Jersey,	40,000 tons.
Georgia,	170,000 tons.	North Carolina,	95,000 tons.
Illinois,	7,500 tons.	Pennsylvania,	100,000 tons.
Indiana,	8,000 tons.	South Carolina,	110,000 tons.
Kentucky,	6,000 tons.	Tennessee,	10,000 tons.
Louisiana.	5,000 tons.	Virginia and West Virginia,	100,000 tons.
Maryland,	75,000 tons.	New England,	75,000 tons.
Michigan,	5,000 tons.	Western States,	25,000 tons.

28. The potash of commercial fertilizers is usually obtained either from the sulphate or the muriate of potash; it is least expensive in the former form and is therefore mainly obtained from either the natural or artificial sulphate.

29. Dr. Marcker, of one of the German Experiment stations draws the following conclusions after a long series of experiments with potash salts on various crops:

30. "Failure in the use of potash salts is very often due to a lack of phosphoric acid and nitrogen in the soil. A direct action of potash salts is only expected on such soils as are naturally deficient in potash, especially light porous soils.

31. "Since by absorption in the soil all potash salts pass into combination with silica, it is of no consequence as far as supplying a deficiency of potash is concerned, whether muriate or sulphate is used. Frequently the cheapest form of potash is the best."

32. "There is no reason to believe that potash salts which contain chlorine are injurious to vegetation; on the contrary, the muriate is often to be preferred because its potash is more thoroughly diffused through the soil. Potatoes and sugar beets, however, are an exception to this rule, since starch or sugar production is decreased by the muriate; tobacco is also injured as to burning quality by the same.

33. "The impure (low grade) potash salts have indirect effects as follows:. 1. They act as solvents on the plant food held in the soil. 2. They keep the soil more moist. 3. They tend to make summer grain ripen earlier."

34. German potash salts (kainit), being a natural production, is very liable to vary much in quality and the amount of actual potash which it contains. During the past few years this variation has been greater than formerly. This variation is due to the want of care (or possibly with a direct intent to deceive) in digging the product from the mines.

35. Of the two forms, Dr. Goessmann of Massachusetts, writes as follows: "The sulphate of potash is unanimously indorsed as the safest potash compound, without regard to kind of crop, and as far as the quality of some industrial products are concerned. It increases the percentage of starch in potatoes and of sugar in beets. It counteracts best, and in common with nitrate of potassa, the tendency of tobacco

to char and to smell offensively, thereby rendering it better adapted to smoking and increasing its commercial value. Upon wet lands alone it is considered unprofitable and the chloride of potassium is considered the safer article."

36. The percentage of potash in unleached wood ashes varies with the kind of wood from which it is made, being highest in hard woods and lowest in soft ones.

37. In many cases farmers are paying too high prices for wood ashes as a source of potash and would find it much more economical to purchase and use high grade potash salts (commercial), and this is especially true where freight and hauling is an object and important item.

38. The higher grade of potash salts are made from the lower ones by the removal of other material (mostly common salt) by inexpensive processes which leave the increased potash at a less cost per pound to the consumer. In cases where the cost per pound is not actually reduced the saving in freight and handling will still make them the most economical source of potash.

39. As to the time at which applications of potash should be made, Goessmann writes: "The experience of German experimenters tends to prove that, as a general rule, the most satisfactory results are obtained by incorporating the potash salts into the soil during the autumn; only in case of a light and sandy soil, which at the same time is quite free from lime and magnesia, do they advise their application in the early part of spring. Their views are well supported by the known physical and chemical reaction of the majority of soils on potash salts and their usual saline admixtures."

40. Chloride of potassa contains 52.4 parts of potassium Pure sulphate of potassa contains 54.9 parts of potassium oxide and 46 parts of sulphuric acid.

41. Commercial muriate of potash contains an average of 50½ per cent. of actual potash. As a means of reducing its value to the price per pound of actual potash, the Connecticut Experiment station publishes the following table:

If quoted at	2.00	cents	per pound.	Actual	potash	costs	3.96	cents	per pound.
"	1.95	"	"	"	"	"	3.86	"	"
"	1.90	"	"	"	"	"	3.76	"	"
"	1.85	"	"	"	"	"	3.66	"	"
"	1.80	"	"	"	"	"	3.56	"	"
"	1.75	"	"	"	"	"	3.46	"	"
"	1.70	"	"	"	"	"	3.36	"	"
"	1.65	"	"	"	"	"	3.26	"	"
"	1.60	"	"	"	"	"	3.16	"	"
"	1.55	"	"	"	"	"	3.06	"	"
"	1.50	"	"	"	"	"	2.96	"	"

42. The nitrogen of commercial fertilizers is derived from numerous sources, varying in their cost and value; among these we may enumerate bone, tankage, fish scrap, nitrate of soda, sulphate of ammonia, dried blood, guano, cotton and linseed pomace and sundry matters, the refuse of other manufactures.

43. Experiment stations assign these various values, but in the following order, and in the following ratio: Ammonia salts, nitrates, ground fish, guanos, dried blood, meat, cotton seed pomace, and in fine bone, eighteen cents per pound; in fine medium bone, sixteen cents; in medium bone, fourteen cents; in course medium bone, fourteen cents; and in course bone, horn shavings and hair, ten cents per pound.

44. In sales from the wholesale dealer to the manufacturer and among manfacturers, nitrogen and nitrogenous materials are sold by the "unit" of nitrogen; that is by the per cent. of nitrogen which they are guaranteed to contain. Thus goods guaranteed to run ten per cent. would be styled "ten units," and others in like proportion. When thus sold the nitrogen is usually quoted as ammonia.

45. In order to facilitate the calculations of the cost per pound of nitrogen, the price per "unit" being given, the Connecticut Experiment station has published the following table:

Ammonia at	$4 00	per unit is	equivalent to	nitrogen at	24.3	cents	per pound.
"	3 90	"	"	"	23.7	"	"
"	3 80	"	"	"	23.0	"	"
"	3 70	"	"	"	22.4	"	"
"	3 60	"	"	"	21.8	"	"
"	3 50	"	"	"	21.2	"	"
"	3 40	"	"	"	20.6	"	"
"	3 30	"	"	"	20.0	"	"
"	3 20	"	"	"	19.4	"	"
"	3 10	"	"	"	18.8	"	"
"	3 00	"	"	"	18.2	"	"
"	2 90	"	"	"	17.6	"	"
"	2 80	"	"	"	17.0	"	"
"	2 70	"	"	"	16.4	"	"
"	2 60	"	"	"	15.8	"	"
"	2 50	"	"	"	15.2	"	"
"	2 40	"	"	"	14.6	"	"
"	2 30	"	"	"	14.0	"	"
"	2 20	"	"	"	13.4	"	"
"	2 10	"	"	"	12.8	"	"
"	2 00	"	"	"	12.2	"	"

46. When the nitrogen is purchased in the form of a sulphate of ammonia, which on a average contains 20.5 per cent. of nitrogen, the price per pound of the sulphate being given. The following table from the same source is convenient for ascertaining the cost per pound of nitrogen:

At	5	cents	per pound.	Nitrogen	costs	24.4	cents	per pound.
"	$4\frac{7}{8}$	"	"	"	"	23.7	"	"
"	$4\frac{3}{4}$	"	"	"	"	23.1	"	"
"	$4\frac{5}{8}$	"	"	"	"	22.5	"	"
"	$4\frac{1}{2}$	"	"	"	"	21.9	"	"
"	$4\frac{3}{8}$	"	"	"	"	21.3	"	"
"	$4\frac{1}{4}$	"	"	"	"	20.7	"	"
"	$4\frac{1}{8}$	"	"	"	"	20.1	"	"
"	4	"	"	"	"	19.5	"	"
"	$3\frac{7}{8}$	"	"	"	"	18.9	"	"
"	$3\frac{3}{4}$	"	"	"	"	18.3	"	"
"	$3\frac{5}{8}$	"	"	"	"	17.6	"	"
"	$3\frac{1}{2}$	"	"	"	"	17.0	"	"
"	$3\frac{3}{8}$	"	"	"	"	16.4	"	"
"	$3\frac{1}{4}$	"	"	"	"	15.8	"	"
"	$3\frac{1}{8}$	"	"	"	"	15.2	"	"
"	3	"	"	"	"	14.6	"	"

47. That the atmosphere is perhaps one of the greatest sources of the nitrogen of plant life, but that the popular opinion that plants can by absorption take it direct from the atmosphere, is in all probability erroneous, and that it must pass first into the soil and there undergo certain changes which fit it for plant food.

48. The two terms "nitrogen" and "ammonia" are interchangable, and are alike used in relation to commercial fertilizers; inasmuch as the ammonia is represented by the largest figures, manufacturers usually prefer to state it in this form. To change the ratio from one to the other we have but to remember that fourteen of nitrogen are equivalent to seventeen of ammonia; hence to change nitrogen into

its equivalent of ammonia we have to multiply by seventeen and divide by fourteen; to change ammonia into nitrogen the reverse is the rule.

49. Some writers divide ammonia, as present in the soil, and fertilizers into two parts, viz, actual and potential; by actual ammonia is meant such ammonia as is in a soluble form and immediately available as crop food; by potential ammonia is meant such ammonia as is not directly available, but which from chemical changes in the soil sooner or later becomes available.

50. Materials containing "organic nitrogen," or "potential ammonia" do not, to any great extent, pass directly into the hands of farmers; they are usually purchased by fertilizer manufacturers at prices which place them beyond the reach of the consumer until they have been mixed with potash and phosphoric acid and take the form of a fertilizer.

51. Fertilizers have been, for the purpose of classification, divided into two divisions, viz: Complete and incomplete; a "complete fertilizer," is said to be one which contains nitrogen, phosphoric and potash; an "incomplete fertilizer" is one which contains but one, or at most two of these classes of elements; of the former class our ordinary superphosphates may be taken as samples; of the latter class we have dissolved South Carolina rock as a sample.

52. Strictly speaking, a "complete fertilizer" is one which supplies to any soil all of the ingredients of plant growth which it lacks, and a "complete fertilizer" for one soil or one crop may be an incomplete one for another.

53. As a rule, all root and leguminous crops require a large proportion of potash, and hence we find all "special" fertilizers for these crops running unusually high in potash; on the other hand, grain crops generally need a preponderance of phosphoric acid; clover is also a large consumer of nitrogen, but seems able, in most cases, to derive the necessary supply from the atmosphere through the soil.

54. The nitrogen of fresh stable manure, by fermentation, is easily and rapidly changed into ammonia and nitric acid, and in this form is volatile and readily lost. If this fermentation can be prevented a great loss of valuable material may also be prevented.

55. Of nitrate of soda Prof. Aitkin writes as follows: "Nitrate of soda is the cheapest and almost the only ready formed nitrate used as manure. It is a true manure. The name "stimulant," frequently used, is a popular error, based upon a misapprehension of its character and use as a nourisher of plants. It is the most soluble and most active of nitrogenous manure at the command of the farmer and these characters determine the circumstances in which it should be used and the mode of its application.

56. Aitken also claims that the solubility of nitrate is such that it rapidly diffuses itself through a damp soil, and to render it available as plant food requires much less moisture than any other form of nitrogen. He also states that "plants are liable to take up nitrates by their roots only when phosphates are in a readily available form and potash salts are present in the soil."

57. It has been claimed that the continued application of nitrate, without a corresponding amount of phosphoric acid and potash, will, by producing a good crop, gradually but surely exhaust the supply of phosphoric acid and potash in the soil.

58. Inasmuch as the nitrate of soda is sold by the pound and of a

certain guaranteed strength, the following table from the Connecticut Experiment Station report is valuable for determining its cost per pound; the table assumes as a basis that the nitrate will average 95 per cent. of the pure salt, which will give 15.6 per cent. of nitrogen:

If quoted at	$3\frac{5}{8}$	cents per pound.	Nitrogen costs	23.2	cents per pound.
"	$3\frac{1}{2}$	"	" "	22.3	"
"	$3\frac{3}{8}$	"	" "	21.5	"
"	$3\frac{1}{4}$	"	" "	20.8	"
"	$3\frac{1}{8}$	"	" "	19.9	"
"	3	"	" "	19.2	"
"	$2\frac{7}{8}$	"	" "	18.3	"
"	$2\frac{3}{4}$	"	" "	17.6	"
"	$2\frac{5}{8}$	"	" "	16.9	"
"	$2\frac{1}{2}$	"	" "	16.0	"
"	$2\frac{3}{8}$	"	" "	15.2	"
"	$2\frac{1}{4}$	"	" "	14.4	"
"	$2\frac{1}{8}$	"	" "	13.6	"
"	2	"	" "	12.8	"

59. Dr. A. P. Aitkin, chemist of the Highland Agricultural Society of Scotland,* in summarizing the results of the society's experiments with nitrogen, draws the following conclusions as to the relative value and merits of sulphate of ammonia and nitrate of soda as a source of nitrogen.

60. "When equal amounts of nitrogen were applied over a rotation in the form of nitrate of soda, and of sulphate of ammonia, it was found that the former was, on the whole, the more productive manure; but these two manures, although closely allied in some respects, have each its special use, and they should not be used indifferently.

61. "Sulphate of ammonia is a less active manure than nitrate of soda, presumably for the reason that it has to be converted into nitrate before it is available for the use of the plant. The relative utility of these two forms of manure may be best understood by keeping that idea clearly in view.

62. "When nitrogen is wanted for the immediate nourishment of the plant, the nitrate is to be preferred; when a less immediate and more prolonged action is wanted, the sulphate is to be preferred; when both an immediate and a prolonged action are wanted, a judicious mixture would seem desirable.

63. "For crops whose growth is rapid, and whose duration is short, the nitrate is, on the whole, preferable, therefore it is very useful for cereals sown in the spring; but when the crop has a long period of growth, as in the case of root crops, the sulphate of ammonia exercises a manurial influence long after the nitrate has disappeared.

64. "Sulphate of ammonia should, therefore, be applied with the seed of cereals rather than as a top-dressing. When sulphate of ammonia is applied as a top-dressing it causes an aftergrowth, which may seriously retard the time of ripening.

65. "Sulphate of ammonia is more firmly retained by the soil than nitrate of soda, so that, unlike nitrate of soda, it cannot be entirely washed out by rain. It is, therefore, more suitable for a wet district, or a wet season, than nitrate of soda. On the other hand, sulphate of ammonia is not so well suited for application to rapidly-growing crops in dry districts or in a season of drought.

66. "During a dry season nitrate of soda, being immediately available if applied with the seed, may save the crop by forcing away the young plant at once, and enabling its roots to get hold of moisture in the lower soil and subsoil before the drought has become severe.

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* See republication by the New York State Agricultural Society.

67. "Sulphate of ammonia can do little for the germinating seed in dry weather, as it is not in an immediately available form; and, even after rain comes, it is some time before the sulphate of ammonia comes into play, so that the result is a diminished crop, or, perhaps, a failure.

68. "Sulphate of ammonia is more suitable than nitrate of soda for mixing with superphosphate and dissolved manures generally, as it is not decomposed thereby. It does not attract moisture so as to render the manure unfit for sowing.

69. "Sulphate of ammonia has been found to check the growth of clover more effectively than nitrate of soda, if applied in excess, but in moderate quantity it is an excellent manure for old grass. It is not so suitable for application to leguminous crops, which are intolerant of strong nitrogenous manures, especially after the first period of their growth.

70. "Pure dissolved bones has this advantage over bone meal, that it contains nitrogen in a soluble, and also in an insoluble, form so that it supplies the wants of the turnip at all periods of its growth; but it has usually the disadvantage of containing lumps of undissolved bone that are unavailable for the turnip crop.

71. "Insoluble nitrogenous manures are substances containing albuminoid matter. They are very suitable for wet districts, but none of them can be considered a manure until it is finely ground, or rotted, or dissolved.

72. "Dried blood and meat meal are supplied in a powdery condition, and are easily rotted in the soil. They are too slowly acting manures for cereal crops usually, but when applied to root crops they decompose in time to yield nitrogen to the plant during the latter part of the growing season.

73. "Horn dust is of various kinds. The only kind that has been successful is a fine sawdust, which is to be had only in small quantity. In that form it is a nitrogenous manure of the highest quality, capable of being used either for cereals or for root crops.

74. "All these nitrogenous matters, when dissolved in sulphuric acid along with phosphates, make manures whose nitrogen is rapidly available for the use of plants. They form the nitrogenous part of what is sold under the name of "dissolved bones," and are as active nitrogenous manures as the gelatine contained in bones which have been dissolved.

75. "It seems to be with nitrogenous manures as it is with phosphates, they are nearly all good alike when they are dissolved. When they are reduced to an exceedingly fine powder they are also very good manures, especially in moist land, but they are of little use when undissolved and only coarsely ground."

76. Of the use of nitrogen, Warrington writes as follows: "Nitrogen applied as ammonium salts or nitrates will give all of its effect during the first year; forty-five to fifty per cent. of the nitrogen applied is, according to Lawes and Gilbert, recovered on an average in the increase. In the case of farm yard manure applied on heavy land at Rothamsted to wheat and barley, only about ten to fifteen per cent. of the nitrogen was recovered in the increase, but the effect on the barley continued many years after the application of the manure ceased. It is evident that a small quanity of an active manure will accomplish the same work as a large quantity of one less active."

77. Of the use of nitrate of soda, Warrington writes as follows:

"This manure, like the preceding (sulphate of ammonia), is valuable solely for its nitrogen. It is an excellent manure for all crops requiring artificial supplies of nitrogen, and especially of grain crops and mangels. For grain crops it is best employed together with a superphosphate. Nitrate of sodium should not be mixed with a damp superphosphate, else the nitric acid may be lost. It is best to mix the two immediately before use, or the superphosphate may be sown with the grain and the nitrate applied afterwards as a top-dressing."

78. In reviewing the experiments of Lawes and Gilbert, Prof. Atwater thus writes: "In Messrs. Lawes and Gilberts' experiments, the cereals have been most helped by nitrogen, next the phosphates and very little by potash; the legumes have responded to mineral manures and paid little heed to nitrogen except where on meadow land they have, under the influence of nitrogenous manuring, gadually run out, and the grasses have taken their place just as they have replaced the grasses where mineral manures alone were used; turnips have done best with superphosphates, and potatoes, I think, have seemed to demand potash along with nitrogen and phosphate for their best development."

79. In reviewing a long series of experiments with different fertilizers, Prof. Atwater thus writes: "The experiments of these seasons (1878, 1879 and 1880) bear unanimous testimony to two things. The corn was helped but little by nitrogen and it gathered a good deal from natural scources. The nitrogen increased the crop enough to pay its cost in thirty trials out of one hundred and fifty, the pecuniary loss rose and fell with the amount of nitrogen used. With mineral fertilizers alone, the crop gathered by the above estimates, some sixty pounds of nitrogen per acre."

80. Of the use of nitrate of soda Prof. Goessmann writes as follows: "A liberal use of this saline compound, or of nitrogen compounds in general, tends to extend the period of vegetation and thus retard the ripening process. The later in the season the sodium nitrate is applied the more serious is its effects on the extension of the period of growth, and the more imminent the danger of obtaining unripe crops. An excessive amount of straw and a small yield of grain in case of our cereals and large watery roots deficient in sugar and such constituents as are formed during the later period of growth, are frequent but practical illustrations of this mode of action."

81. Sir J. Bennett Lawes writes as follows in relation to large applications of nitrogen: "These large applications of potash and phosphoric acid, although applied in the form of soluble compounds, appear to enter into very fixed combinations somewhat similar to those already existing in the soil, and in this respect they differ altogether from compounds of ammonia and nitric acid, as the latter appear to be either washed away or destroyed, unless they are fixed by vegetation, while the former are fixed by the soil itself and are only taken out of it by means of vegetation."

82. In referring to the use of different kinds of fertilizers, the same authority writes as follows: "Manures consisting of potash, phosphoric acid and ammonia or nitrates, appear competent to grow large crops of wheat continuously. A given weight of nitrogen, as nitric acid, has produced more growth in the wheat crop than the same weight of nitrogen in salts of ammonia. The amount of nitrogen supplied in the manures is very much in excess of the amount recovered by the increase in the crops."

83. A noted English writer states that "we estimate that about thirty pounds of nitrogen, as nitric acid, are liberated each year, of which the crop takes about twenty pounds and the drainage water ten pounds. There are several thousand pounds of nitrogen in combination with carbon still in the soil. It is evident, however, that the wheat crop cannot make use of this source of fertility, but is entirely dependent upon the limited amount of nitric acid available each year, of which the larger portion is liberated from the soil."

84. The same writer states: "Mineral manures do not, therefore, *prevent* the exhaustion of the soil, but they enable the plant to utilize the nitrogen which would otherwise be lost. This is very clearly shown by the fact that very large amounts of nitric acid pass away in the drainage water where we apply nitrates and ammonia every year without any minerals."

85. Prof. Lawes writes: "When ammonium salts are applied to land, the ammonia is at first retained by the soil, while the sulphuric acid and chlorine pass into the drainage water, chiefly as calcium salts. The conversion of ammonia into nitric acid commences almost immeiately after the application of ammonium salts to wet soil. The conversion is complete in a few weeks if wet weather follows. The nitrogen of rape-cake is more slowly converted into nitric acid."

86. Many of the so-called "waste products," which contain nitrogen or potash, are sold at prices much above their real value, or above their value when compared with the market rates for the same materials in the less adulterated commercial form.

87. In many cases these products are purchased and heavy freight (in addition to first cost) paid to the station of the consumer, when the same materials could have been purchased in some well-known fertilizer at less rates, and much handling saved.

88. Some chemicals which produce certain known results when separately applied to the soil will, when in state of mixture, produce much greater results.

89. This increase in the results produced is dependent, first, upon the completeness of the mixture, grinding together being much preferable, and, second, upon the time which has elapsed since they were brought together, it being an established fact that a certain amount of time is necessary for the chemical changes which are known to take place.

90. Thus, lime and salt, when applied separately, produce a given effect upon certain crops, but when thoroughly incorporated and mixed some six months before the application is made, are found to produce a much greater effect.

91. Some chemicals, in addition to the effect which their direct application may exert on the crop as direct plant food, also produce a visible effect by changing chemical compound in the soil, and by this change rendering their component parts available as plant food.

92. Thus the application of lime and the effects which follow cannot be attributed to the addition of lime as plant food. They are clearly due to the result of a chemical decomposition which the lime induces in the soil, and which in its results forms new compounds or releases the valuable portions of those already existing.

93. It is on account of this thorough mixture, induced by grinding the component parts together, and allowing them to thus lay for some time, that fertilizers mixed in bulk at the factory will always give bet-

ter returns than those imperfectly mixed with a shovel upon the barn floor.

94. The economical utilization of any product as a fertilizer depends upon the freight, first cost and the percentage of the material needed which it may contain. The cost per ton may be small, but if it at the same time contains but a small portion of the substance actually wanted, it may still prove to be dear to the purchaser. Freight and handling play an important part in the first cost of fertilizers.

95. In addition to the first cost of his materials, the manufacturer is compelled to add commissions to agents, interest upon capital locked up by sales made on time and freight. When these are all added, the competition of the trade will often cut profits down to a low margin.

96. Certain compounds containing nitrogen have it in such a form that it is not readily lost. By the addition of certain chemicals it is possible to destroy that condition, and by a change of bases render it much more volatile and subject to loss.

97. On this account it is bad policy to mix wood ashes (unleached) or fresh lime with chicken manure or fertilizers containing nitrogen. The nitrogen is, by a change of base, permitted to pass into a more volatile form and passing off into the atmosphere. To prove this, mix a small portion of quicklime with chicken manure in a small box or bottle.

98. In all cases it is essential to the best success that all of the ingredients of a fertilizer should be in a finely pulverized condition. as well as in a state of thorough and complete mixture. Many scientific men state that South Carolina rock if pulverized to a sufficient degree of fineness will give nearly or quite as good results as if treated with acid. The main difference being that in the "raw" state it requires more water to render it soluble.

99. What has thus been urged for South Carolina rock is, to a certain extent, no doubt true as to other fertilizer materials and that we may assume that fine division, whether secured by mechanical or chemical action, is the one thing to be sought after.

100. That in the valuation of commercial and other fertilizers we are not justified in placing a low value upon vegetable or organic matter, since it is clearly shown that it is one source of ammonia and that its mechanical effect is very important also.

THE PRESERVATION OF BARN-YARD MANURE.

By PROF. WM. FREAR, *State College, Pennsylvania.*

Within a comparatively recent period there has been a vast increase in the application of fertilizers upon the soil of our farms, whose original supply of assimilable plant-food had been heavily drained. In the earlier stages of this movement, attention and interest were chiefly centered upon the manure of home production; but latterly, the rapidly increasing production of commercial fertilizers has diverted attention from the manure produced upon the farm. Not only has the early skepticism concerning the practical utility of commercial fertilizers been completely overthrown, but many, following the bold leadership of Prof. Ville, have ventured to assert their complete independence of any form of fertilizer, except the concentrated, artifi-

cial supplies. They oppose the general practice of that mixed system of farming which includes the raising of cattle, or the production of milk, and the dependence upon the manure thus made for the maintenance of fertility, claiming that it must necessarily be a losing system. They claim, apparently with much force, that it is impossible to increase the amount of plant-food on a poor farm by the simple return to the soil of the materials removed from it, much less by the return of only a part of what has been removed. Just here it must be recalled that the available plant-food in a cultivated soil is made up not only of that which has been added as fertilizer, but, also, of that which has been formed, by chemical decomposition and mechanical subdivision, from that great portion of the soil previously unfit for assimilation by the plants; it must further be remembered that the retention in the soil of a fair amount of humus, or organic matter formed by the decomposition of roots, straw, etc., is a very important element in the maintenance of its fertility.

It would seem, then, that the value of farm-yard manure cannot be measured simply by its content in nitrogen, potash and phosphoric acid. The problem of fertilization is, therefore, more complex than might be supposed, and it will be safe, while admitting the great utility of the commercial fertilizers as *additions* to the manure of home production, to regard the extreme conclusions of the Ville school as deserving experiment, rather than as proven to be best for general adoption under our present agricultural conditions.

Under any circumstances, however, and with every system of farming, the prompt return to the soil of the largest possible portion of those materials removed therefrom, that cannot more profitably be sold, must be regarded as essential; *i. e.*, whether the amount be great or small, it should be returned in the most economical manner. It is a well-known fact to all observing farmers, that the practical agriculturist who accumulates wealth, whether in the shape of cash, stock, acres or fertility, does so, not by great discoveries, nor in great sums, but by constant vigilance, and the most careful, intelligent economy in matters of apparently small importance; while a poor farmer is marked by his heedlessness of the little things, even more than by his lack of the great and costly appliances of his art.

Observation leads to the conclusion that in no matter is there more ignorance and more unconscious waste than in the management of the stable manure. The character of this manure will vary with the feeding-stuffs used, the kind of stock fed and the litter used; all of which have great importance in any study of the manure question; it is, however, to the influence of the methods of its preservation upon the composition of the manure, rather than to the materials employed in its production, that I desire to call attention.

Before entering upon any discussion of the relative merits of different methods of preservation, it may be well to glance briefly at the character of the substances composing yard manure.

Dr. Voelcker *analyzed a mixture of horse, cow and pig dung with straw litter, and found in one thousand pounds the following weights of various substances:

	Pounds.
Water,	661.7
Organic matter,	282.4
Ash,	55.9
	1000.0

*Journal of the Royal Agricultural Society, series I, vol. XVII, p. 191 *seq.*

In a ton of the same manure he found the following quantities of valuable fertilizer constituents:

	Pounds.
Nitrogen,	12.75
Phosphoric acid,	6.50
Potash,	13.50

Warington* gives the following summary of many reliable analyses of different stable manures:

	Per cent.
Water,	65.0 to 80.0
Nitrogen,	0.4 to 0.65
Ash,	2.5 to 3.0
Potash,	0.4 to 0.7
Phosphoric acid,	0.2 to 0.4

A single ton of yard manure will, therefore, supply:

	Pounds.
Nitrogen,	9 to 15
Potash,	9 to 15
Phosphoric acid,	4 to 9

So that the total quantity of constituents having a direct fertilizing value will vary between twenty-two and thirty-nine pounds per ton.

It will be remembered that dung is composed of those substances which have been exposed to the action of the digestive ferments, and have either resisted their action, or having been dissolved, have escaped absorption. The dung also contains traces of the digestive fluids which have not been resorbed.

Urine contains urea and allied nitrogenous compounds, which are very fermentable, together with notable quantities of inorganic substances.

The straw of the litter is, also, when moistened and heated, liable to rapid decomposition through the agency of a certain *bacterium*, or microscopic organism.

It is thus seen that every part of the manure is readily fermentable. The amount of moisture, the degree of temperature and the access of air regulate the fermentation.

As a first stage of this fermentation, the fiber and other carbonaceous matters form water, carbonic acid and certain obscure organic acids, called, in general, humic acids. The nitrogeneous matter breaks up to form ammonia as its chief product. At this stage of fermentation the ammonia unites with the humic acids to form soluble, but non-volatile compounds. These may be removed from the heap by leaching, and form a very important part of the dark-colored liquids that trickle away unheeded from so many of our barn yards.

In the second stage of fermentation, which may be almost immediately induced by too little moisture, too high temperature, and too free access of air, the carbonaceous matter form carbonic acid chiefly or altogether; the ammonia unites with this product to form volatile carbonate of ammonia, which will not only leach away in drainage waters, but will be rapidly dissipated into the atmosphere. The humic acids themselves are broken up into carbonic acid and water. When too little litter has been used, there is serious danger of large loss of ammonia in the form of carbonate.

Having thus obtained a cursory view of the general character of yard manure and its fermentation products, let us proceed to examine some of the more exact experiments that throw light upon the subject

*The Chemistry of the Farm, p. 32.

of its preservation. Your attention is invited to three series of experiments, the first having for its object a knowledge of the losses resulting from the storing of yard manure in the several ways usually adopted; the second, a knowledge of the relation of litter to its preservation; and the third, a knowledge of the relative values of several preservatives, the addition of which to manure heaps has been suggested.

The first of the above mentioned series of experiments was made by Dr. Voelcker* a number of years since. He studied the changes occurring from time to time in fresh-mixed dung exposed in the following ways:

A. In a heap, open to the rain.
B. In a heap, under cover.
C. Spread out and exposed to the rain.

These experiments were carried on simultaneously, the manure coming from the same source, and being thoroughly mixed. The quantities used were weighed on the same dates, samples of each were drawn and analyzed, and from the results obtained the changes in composition ascertained. In table I are given the absolute weights at the various dates of weighing of the different constituents of the manure treated according to these several methods. Dr. Voelcker made an experiment, for comparison, starting with manure of six months' age, well rotted, and exposed under the same conditions as the first heap of fresh manure and during the same time. The results of this experiment are tabulated with those first mentioned:

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*Journal of the Royal Agricultural Society, 17, 191-260.

TABLE I.—*Results of Dr. Voelcker's Experiments.*

DATE OF WEIGHING.	Weight of heap.	Water.	Total organic matter.	Total inorganic matter.	Total nitrogen.	Soluble organic matter.	Insoluble organic matter.	Soluble mineral matter.	Insoluble mineral matter.	Nitrogen in soluble matter.	Nitrogen in insoluble matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
I. November 30, fresh:	10,000	6,617	2,824	559	64.3	248	2,576	154	405	14.9	49.4
December 5, well-rotted,	10,000	7,542	1,653	805	60.6	371	1,282	147	658	29.7	30.9
II. April 30, fresh:											
a. Exposed in heap,	7,138	4,707	1,678	753	63.9	305	1,373	204	549	21.4	42.5
b. Covered,	4,960	2,823	1,490	616	59.0	230	1,260	167	479	13.4	45.6
c. Exposed, spread out,	8,650	6,922	1,092	636	45.9	100	992	87	549	6.9	39.0
Well-rotted, exposed in heap,	7,353	5,072	1,327	954	66.4	162	1,165	123	831	10.7	55.7
III. August 23, fresh:											
a. Exposed, in heap,	7,025	5,304	1,064	657	46.3	207	857	138	519	13.2	33.1
b. Covered,	4,000	1,737	1,205	1,057	50.8	165	1,040	122	935	10.4	40.4
c. Exposed, spread out,	6,130	4,297	677	1,155	25.0	30	647	39	1,116	3.6	21.4
Well-rotted, exposed in heap,	6,843	4,582	945	875	36.5	95	850	70	805	5.6	30.9
IV. November 15, fresh:											
a. Exposed, in heap,	6,954	5,167	947	840	46.0	190	757	130	710	12.9	33.1
b. Covered,	3,790	1,579	1,253	958	57.2	203.5	1,049	168	790	15.9	41.3
c. Exposed, spread out,	5,750	3,771	595	1,384	22.4	24	571	33	1,351	1.7	20.7
Well-rotted, exposed in heap,	6,219	4,574	828	981	40.7	61	767	65	866	5.7	35.0

Without attempting any discussion of these interesting results, let us turn at once to the conclusions drawn from them by Dr. Voelcker:

"*First.* Perfectly fresh farm-yard manure contains but a small proportion of free ammonia.

"*Second.* The nitrogen in fresh dung exists principally in the state of insoluble nitrogenized matters.

"*Third.* The soluble organic and mineral constituents of dung are much more valuable fertilizers than the insoluble. Particular care, therefore, should be bestowed upon the preservation of the liquid excrements of animals, and for the same reason the manure should be kept in perfectly water-proof pits of sufficient capacity to render the setting up of dung heaps in the corners of fields, as much as it is possible, unnecessary.

"*Fourth.* Farm-yard manure, even in quite a fresh state, contains phosphate of lime, which is much more soluble than has hitherto been suspected.

"*Fifth.* The urine of the horse, cow and pig does not contain any appreciable quantity of phosphate of lime, whilst the drainings of dung heaps contain considerable quantities of this valuable fertilizer. The drainings of dung heaps, partly for this reason, are more valuable than the urine of our domestic animals, and, therefore, ought to be prevented by all available means from running to waste.

"*Sixth.* The most effectual means of preventing loss in fertilizing matters is to cart the manure directly on the field whenever circumstances allow this to be done.

"*Seventh.* On all soils with a moderate proportion of clay no fear need be entertained of valuable fertilizing substances becoming wasted if the manure cannot be plowed in at once. Fresh, and even well-rotten, dung contains very little free ammonia, and since active fermentation, and with it the further evolution of free ammonia, is stopped by spreading out the manure on the field, valuable volatile manuring matters cannot escape into the air by adopting this plan.

"As all soils with a moderate proportion of clay possess, in a remarkable degree, the power of absorbing and retaining urine matters, none of the saline and soluble organic constituents are wasted, even by a heavy fall of rain. It may, indeed, be questioned whether it is more advisable to plow in the manure at once, or to let it lie for some time on the surface, and to give the rain full opportunity to wash it into the soil.

"It appears to me a matter of the greatest importance to regulate the application of manure to our fields so that its constituents may become properly diluted and uniformly distributed amongst a large mass of soil. By plowing in the manure at once, it appears to me, this desirable end cannot be reached so perfectly as by allowing the rain to wash in gradually the manure evenly spread on the surface of the field.

"By adopting such a course, in case practical experience should confirm my theoretical reasoning, the objection could no longer be maintained that the land is not ready for carting manure upon it. I am inclined to recommend as a general rule: Cart the manure on the field, spread it at once, and wait for a favorable opportunity to plow it in. In the case of clay soils, I have no hesitation to say the manure may be spread even six months before it is plowed in without losing any appreciable quantity in manuring matters.

"I am perfectly aware that on stiff clay land farm-yard manure,

more especially long dung, when plowed in before the frost sets in, exercises a most beneficial action by keeping the soil loose, and admitting the free access of frost, which pulverizes the land, and would, therefore, by no means recommend to leave the manure spread on the surface without plowing it in. All I wish to enforce is, that when no other choice is left but either to set up the manure in a heap in a corner of the field, or to spread it on the field without plowing it in directly, to adopt the latter plan. In the case of very light, sandy soils it may, perhaps, not be advisable to spread out the manure a long time before it is plowed in, since such soils do not possess the power of retaining manuring matters in any marked degree. On light, sandy soils I would suggest to manure with well-fermented dung shortly before the crop intended to be grown is sown.

"*Eighth.* Well-rotten dung contains, likewise, little free ammonia, but a very much larger proportion of soluble organic and saline mineral matters than fresh manure.

"*Ninth.* Rotten dung is richer in nitrogen than fresh.

"*Tenth.* Weight for weight, rotten dung is more valuable than fresh.

"*Eleventh.* In the fermentation of dung a very considerable proportion of the organic matters in fresh manure is dissipated into the air in the form of carbonic acid and other gases.

"*Twelfth.* Properly regulated, however, the fermentation of dung is not attended with any great loss of nitrogen or saline mineral matters.

"*Thirteenth.* During the fermentation of dung, ulmic, humic and other organic acids are formed, as well as gypsum, which fix the ammonia generated in the decomposition of the nitrogenized constituents of dung.

"*Fourteenth.* During the fermentation of dung the phosphate of lime which it contains is rendered more soluble than in fresh manure.

"*Fifteenth.* In the interior and heated portions of manure heaps ammonia is given off; but on passing into the external and cold layers of dung-heaps the free ammonia is retained in the heap.

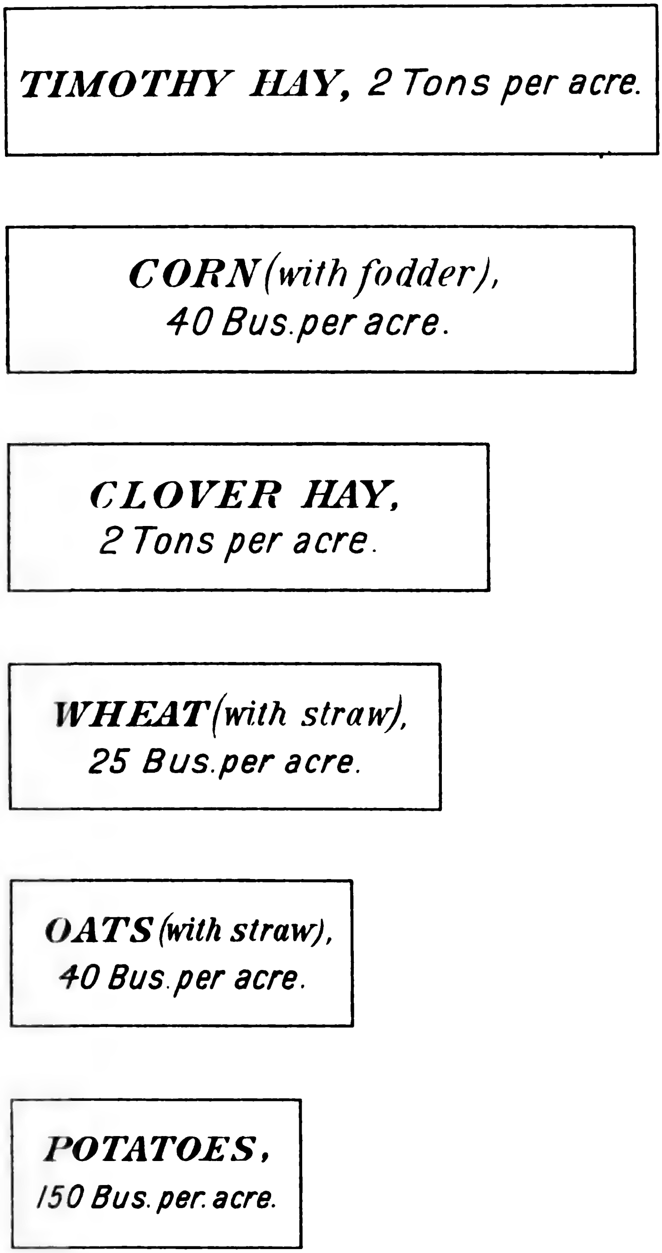
"*Sixteenth.* Ammonia is not given off from the surface of well-compressed dung heaps, but in turning manure heaps it is wasted in appreciable quantities. Dung heaps for this reason should not be turned more frequently than absolutely necessary.

"*Seventeenth.* No advantage appears to result from carrying on the fermentation of dung too far, but every disadvantage.

"*Eighteenth.* Farm-yard manure becomes deteriorated in value when kept in heaps exposed to the weather; the more the longer it is kept.

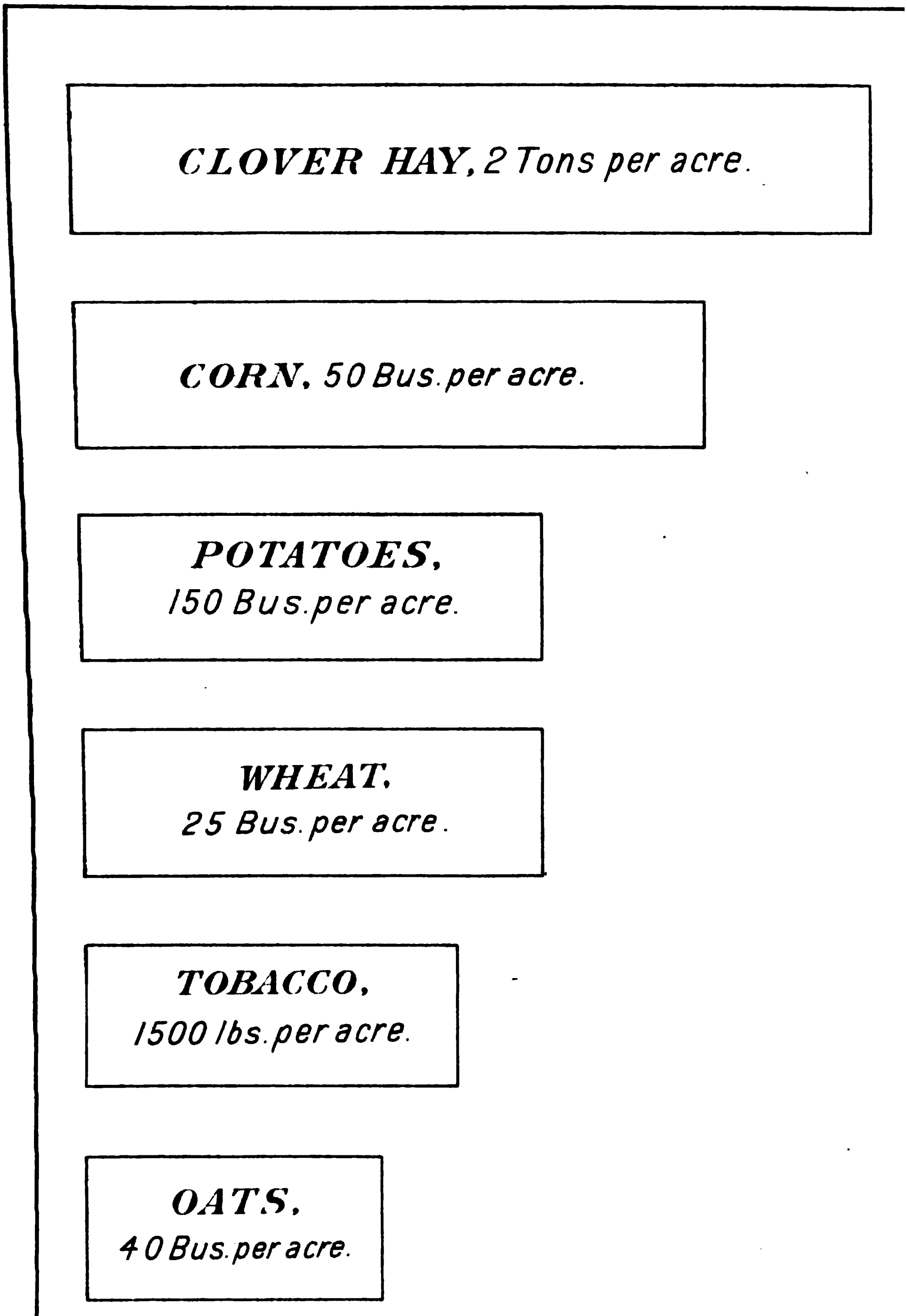
"*Nineteenth.* The loss of manuring matters which is incurred in keeping manure heaps exposed to the weather is not so much due to the volatilization of ammonia as to the removal of ammoniacal salts, soluble nitrogenized organic matters and valuable mineral matters by the rain which falls in the period during which the manure is kept.

"*Twentieth.* If rain is excluded from dung heaps, or little rain falls at a time, the loss in ammonia is trifling, and no saline matters of course are removed, but, if much rain falls, especially if it descends in heavy showers upon the dung heap, a serious loss in ammonia, soluble organic matters, phosphate of lime and salts of potash is incurred, and the manure becomes rapidly deteriorated in value, whilst at the same time it is diminished in weight.



COMPARATIVE EXHAUSTION OF PHOSPHORIC ACID.

The whole crop being removed.



COMPARATIVE EXHAUSTION OF PHOSPHORIC ACID.

The straw & fodder being returned to the soil.

" *Twenty-first.* Well-rotten dung is more readily affected by the deteriorating influence of rain than fresh manure.

" *Twenty-second.* Practically speaking, all essentially valuable manuring constituents are preserved by keeping farm-yard manure under cover.

" *Twenty-third.* If the animals have been supplied with plenty of litter, fresh dung contains an insufficient quantity of water to induce an active fermentation. In this case fresh dung cannot be properly fermented under cover, except water or liquid manure is pumped over the heap from time to time.

" When much straw is used in the manufacture of dung, and no provision is made to supply the manure in the pit at any time with the requisite amount of moisture, it may not be advisable to put up a roof over the dung pit. On the other hand, on farms when there is a deficiency in straw, so that the moisture of the excrements of our domestic animals is barely absorbed by the litter, the advantage of erecting a roof over the dung pit will be found very great.

" *Twenty-fourth.* The worst method of making manure is to produce it by animals kept in open yards, since a large proportion of valuable fertilizing matters is wasted in a short time; and after a lapse of twelve months, at least two-thirds of the substance of the manure is wasted, and only one-third, inferior in quality to an equal weight of fresh dung, is left behind."

It may be well to remark at this point that, although the experiments just detailed deal only with the stall system of manure keeping, the general results of the box system may be closely approximated from the knowledge obtained.

The second series of experiments, to which your attention is now called, was conducted by MM. Muntz and Girard,* upon the Joinville farm of the Agricultural Institute of France.

" These experiments," the authors say, were undertaken,

" *First.* To ascertain what relation exists between the fertilizing constituents of the food and of the excrément, *i. e.*, what the losses are that result from fermentation and evaporation, as well as those due to the handling of the manure.

" *Second.* To discover what quantity of fertilizing substances animals put in pasture return to the earth in exchange for the forage removed, when the animals pass part of their time in the stable, where, without receiving food, they drop a portion of their excrement."

The animals were kept in the stable under three different conditions. In the first case, the floor of the stable was pitched, and no litter was used, with sheep and cows being experimented upon ; second, straw litter was used, and two lots of food, one green, the other dry, were fed, sheep being the animals subjected to experiments; in the third case, the floor of the stable was covered with fresh earth.

In all cases, the food eaten was weighed, sampled and analyzed, due allowance being made for that part which was thrown from the mangers upon the floor and trampled into the manure; the manure was also weighed, sampled and analyzed, due allowance being made for the litter. The changes in live weight of the animals were noted, and, from the well-known results of other experiments, an estimate was made of the fertilizing substances stored up in the increase of live weight. From the records thus obtained, the data given in Table II were gathered.

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*Bulletin de la Societes des Agriculteurs de France, annales agronomiques, 12, 429.

TABLE II.—*Results of Experiments of Muntz and Girard.*

Conditions of Experiment.	Phosphoric Acid		Potash.		Nitrogen.					
	In food consumed.	In manure.	In food consumed.	In manure.	In food consumed.	In flesh formed.	In milk.	In manure.	Loss.	Per cent. of loss.
	*Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	
Sheep (82),	.....	.....	.....	.....	21.817	4.300	.....	5.588	12.129	55.58
Cows (2),	.....	.....	.....	.....	14.146	0.514	2.560	7.461	3.581	25.30
Sheep, straw litter, green feed,	2.952	2.955	13.002	15.280	14.548	1.089	.....	6.349	7.110	48.87
Sheep, straw litter, dry feed,	5.124	4.836	18.002	17.930	23.011	1.670	.....	8.899	12.442	51.08
Sheep, earth litter, green feed,	2.820	3.260	13.235	12.017	13.707	1.879	.....	9.042	2.376	23.98

* 1 kilo—2.2 pounds about.

The enormous loss of nitrogen from unlittered sheep manure is noteworthy. Owing to the physical condition of cow manure, it seems to have suffered less active fermentation, and consequently less loss. The authors attribute the loss mainly to the formation of carbonate of ammonia, and on analysis of the air of the stable, found it to contain about four hundred times the normal amount of ammonia. "It is well," they say, "to remark that these figures prove only that a notable quantity of carbonate of ammonia was diffused in the air of the stables, and that this diffusion is one of the causes of the loss of nitrogen, but the foregoing figures show only the nitrogen that has escaped in the form of ammonia; M. Reiset has long since shown that during the fermentation of animal excreta, a part of the nitrogen is given off in a free state, and M. Joulie has recently reached the same conclusion."

Examining the results, first with reference to the proportion of potash and phosphoric acid recovered in the manure, it is found that practically the whole amount consumed is recovered in every experiment.

But turning to the figures representing the amounts of nitrogen recovered, we find a marked difference. With straw litter the amount lost is very little less than with no litter at all, viz, almost fifty per cent. It is also worthy of note, that with the dry ration, which contained a considerably higher proportion of nitrogen than was present in the green food, the loss was relatively greater. It must here be remembered that the statements concerning the effect of straw litter, are warranted only in the case of the very concentrated sheep manure, and must not be regarded as exact for other kinds of manure. Concerning the experiment with earth litter, the authors make the following statement: "To gain a fair idea of the quantity of fertilizer preserved by pasturing, the authors placed in one of the stables, a layer of earth eight to ten inches deep. At the close of the experiment the manure was taken up; two distinct layers were seen; the first was composed of the excreta, a little debris from the lucerne fed, mixed with a considerable quantity of earth. This layer gave out a slightly ammoniacal odor, but less than the straw litter.

"The second layer was composed of soil unchanged from its original condition; *i. e.*, the excreta were retained upon the surface."

Upon the results of these experiments the authors remark: "Finally, when a litter of earth is substituted for that of straw, the loss of nitrogen becomes much less; instead of a loss of fifty per cent., we have one of only twenty-four per cent.; a quarter of the nitrogen has, by this practice, been retained upon the farm, in place of being uselessly diffused into the atmosphere as in the preceding cases. It seems that, in practice, the substitution of a litter of earth for that of straw would prevent a large part of the enormous loss of nitrogen previously referred to. We call the most serious attention of practical men to this subject."

"Turning to the question of herding, and remembering that the fertilizers are dropped by the sheep directly upon the soil, if we admit that the soil of the fields has the same properties as that used as litter, we establish the fact that a greater part of the fertilizing constituents of the excreta are retained by the soil; by stabling upon a straw litter a large proportion of these constituents is lost into the atmosphere. There is, therefore, a difference between the practice of allowing sheep to drop their excreta directly upon the soil, and that of collecting the excreta in the stables and carrying them to the field."

The third and last series of experiments, which deals with the relative values of several preservatives added to the manure, was conducted by Hickethier and Holdefleiss.* The plan of the experiment was as follows: The quantity of cow manure gathered in a single week was thoroughly mixed and divided into four heaps, samples being taken for analysis at the same time. To the first heap no addition was made; heap No. 2 received a weighed quantity of kainite, which was thoroughly mixed with the dung; heap No. 3 received a quantity of superphosphate-gypsum—essentially a very poor superphosphate, containing 4 per cent. of soluble and 6.5 per cent. of total phosphoric acid, together with about 60 per cent. of sulphate of lime; heap No. 4 was covered with a soil rich in humus. These heaps stood from June 6 to January 6, exposed only to the direct rainfall, leaching being prevented. After this period, the heaps were again weighed and sampled for analysis.

While the manure in heaps 1, 2 and 4 was almost equally decomposed and quite well rotten, that of heap No. 2 was as fresh as stable manure a few weeks' old; its straw afforded considerable resistance to tearing, so that there is no doubt that the manure treated with kainite had decomposed very slightly as compared with that of the other heaps.

The loss of *dry substance* in heaps 1 and 3 was 11.2, 11.9 and 22.5 per cent., respectively. The amount of earth used on heap No. 4 was not weighed, hence it was impossible in this case to determine the loss of dry substance.

The authors remark: "These figures show:

"(*a.*) That stable manure, lying without any added preservative, suffers a loss in dry substance amounting to one-third. Since the value of stable manure depends very largely upon its content of organic matter, which forms humus in the soil, it is evident that a great diminution in value is caused by this loss of organic substance alone.

"(*b.*) The loss of organic substance was considerably diminished by the presence of superphosphate gypsum; but the loss was still very considerable.

"(*c.*) By using kainite as a preservative, the loss of organic substance was reduced to a relatively small quantity. But dung treated with kainite, by reason of its slight degree of fermentation, decomposes quite slowly in the soil, and, from this point of view, is inferior to the more completely rotted, and therefore, more quickly acting manure treated with superphosphate gypsum."

Table III gives the final results of the experiments as far as the composition of the manure is concerned.

*Der Landwirt, Jahrg, 1885, Nr. 79. Bedermann's Central-Blatt, *15*, p. 24.

TABLE III.—*Experiments of Hickethier and Holdefleist. Changes in Manure on Standing.*

TREATMENT OF MANURE.	Weight of fresh manure.	Total nitrogen.	First weight of nitrogen.	Weight of nitrogen at end of experiments.	Loss or gain.	Percentage of loss or gain.
	*Centners.	Per cent.	†Lbs.	Lbs.	Lbs.	
1. Without admixture, ...	123	0.3960	48.71	37.35	−11.36	−23.36
2. With kainite, ...	121	0.4008	48.50	48.57	0	0
3. With superphosphate gypsum, . .	121	0.4113	49.77	52.05	+2.28	+4.6
4. With earth covering, ...	120	0.4356	52.27	51.13	−1.14	−2.2

* = 110 Avoirdupois lbs. † = 1.1 Avoirdupois lbs.

The loss in nitrogen of the dung without admixture was 23 per cent this seems, from the results of other experiments by the same investigators, to be considerably less than the usual quantity. If the amount of manure produced yearly by cattle, per head, be estimated at 35,000 pounds, with an average nitrogen content of 0.41 per cent., the annual loss per head would be 33.5 pounds, an amount of nitrogen greater than that contained in 200 pounds of nitrate of soda.

The preservatives added produced the following effects:

In the heap receiving kainite, the quantity of nitrogen remained unchanged. This result indicates not only the strong preservative action of kainite, but also, that the experiment was free from error.

In the heap receiving superphosphate gypsum, an increase was found of 4.6 per cent over the original quantity of nitrogen. This increase may be only apparent, and due to error in sampling or analysis; but it may be due, as well, to the fact that superphosphate gypsum has, not only by reason of its content of gypsum, but also on account of the free phosphoric acid present, the power of absorbing ammonia from an ammoniacal atmosphere. The experimental heaps, of which No. 1 gave off considerable quantities of ammonia, stood close together, and the sheep stable was in their immediate vicinity; so that there was a possibility that the heap with superphosphate gypsum, took up ammonia from the atmosphere, and so not only retained all its own nitrogen, but even stored up an additional amount.

The heap covered with earth had lost an inconsiderable quantity of nitrogen, only 2.2 per cent. of the original amount. This method of preservation, therefore, which has long been known and frequently employed, fulfills its purpose in great measure.

As a further test of the value of the above mentioned preservatives, a culture test of the resulting manure was made. The heaps were distributed on exactly similar plots, separated by plots receiving no fertilizer, and the plots were planted with potatoes. The weight of tubers obtained, and the percentages and absolute quantities of starch yielded by them, are shown in Table IV.

TABLE IV.—*Yield with Manures treated with Different Preservatives.*

Plot No.	FERTILIZER.	Weight of tubers.	Percentage of starch.	Weight of starch.
		**Centners per †morgen.*		*Lbs.*
1.	Dung without admixture,	109.3	19.1	2088
2.	Unfertilized,	97.1	19.1	1855
3.	Dung with superphosphate gypsum,	135.1	19.5	2634
4.	Unfertilized,	100.6	21.2	2133
5.	Dung with kainite,	117.3	17.4	2041
6.	Unfertilized,	105.7	20.3	2146
7.	Dung with earth,	129.2	18.5	2390

* For English equivalents see Table III. †Equal to nearly two-thirds of an acre.

These results indicate that the effect of kainite, measured by the yield obtained, was considerably less than that of superphosphate gypsum, and of the earth covering.

To conclude: The results obtained by these experiments indicate that serious loss results from the keeping of yard manure too long, or under conditions conducive to excessive fermentation or leaching; and that these unfavorable results may be avoided; first, by the prompt removal of the manure to the land, in case the latter is at all retentive in character; second, by the careful protection of manure so as to secure the proper degree of moisture and fermentation; third, by the use, in addition to the precautions just mentioned, of preservatives, as superphosphate gypsum or earth, mixed with or covering the manure.

There is not the least doubt but that the intelligent application of the facts learned from these experiments would, without involving any considerable additional labor or expense, add greatly to the agricultural resources of a large class of our farmers.

THE EFFECT OF FERTILIZERS UPON THE TOBACCO CROP.

By the SECRETARY.

At a recent meeting of the Lancaster County Agricultural Society, at the close of an address on Commercial Fertilizers, by Hon. John W. Hickman, the subject of the effect of commercial fertilizers upon the burning qualities of tobacco was incidentally brought into the general discussion of the fertilizer question, and it was suggested by Hon. J. P. Wickersham that the subject should be referred to the Secretary of the State Board of Agriculture, for an investigation and report. The following compilation is the result of an attempt to comply with this request, and if the practical assistance of our tobacco growers is extended to the Board, this report may be regarded as preliminary to

a further investigation into the whole question of the effect of commercial and natural fertilizers upon the crop under consideration.

At the commencement of the examination, circular letters were sent to many of the leading tobacco growers of our State; in these letters certain questions were asked and the resulting replies, though not as numerous as would have been desired, are of great value in formulating conclusions and in obtaining practical data in relation to the subject in hand. From the very first it was evident that in conducting the investigation we should not be at loss for information of a theoretical character; numerous theories were at once offered and it became the duty of the Secretary to sift them and discard all such as would not bear the test of practice; numerous manufacturers of commercial fertilizers advanced (to them) incontrovertible arguments to show that their special "tobacco fertilizer" was just the very thing to produce a crop of good burning weed, and that no matter what the nature or condition of the soil, its application would always insure a good crop. Of the immense mass of correspondence which reached us the *practical* occupied but (comparatively) a small space, and by applying this small portion of known practical information, we were at once enabled to eliminate much of that which was merely theoretical and which in many cases came from scientific sources.

At the meeting alluded to it was estimated that the solution of the question was easy and depended entirely upon scientific tests and chemical analyses; but those who have given even superficially, an examination of the topic assigned us, know very well the utter unreliability of chemical analyses when applied to our soils; and that nature has a practical way of dealing with the union of fertilizers and soils which utterly upsets all scientific theories; thus we may know what our soil contains; we may have a correct chemical analyses of the ash of the crop, and we may have a reliable analyses of our fertilizer and think that from these three we can easily solve the problem we may have in hand; but the chemical changes and recompositions which always take place in the soil assert themselves and upset all preconceived theories. With no crop do we find this more certain in its effect than in that of tobacco; and this is probably due to the fact that it is put to a mechanical test, to which no other crop is subjected, viz: that of burning with an ash of a certain consistency and character. The analysis of the ash of any of our ordinary grain crops will give us an insight (at least partially) into the composition of a proper fertilizer, but in the case of the tobacco crop we find a complication arising from the unknown effect of constituents in the soil upon chemicals in our fertilizer, which confuses all of our theories. Thus, for instance, we find that in applying potash to our grain crops it is merely a question of the most economical form in which it may be used; it appears to matter little, beyond the question of comparative cost, what the form or grade may be, we may use a low grade with economy, provided we do not have to pay too much freight on it; in case the supply is near at hand, wood ashes may be economical; at points further removed from the source of supply, kainite may be used with economy; but at the more distant points only the higher grades of commercial salts of potash can be economically used; in all of these cases we must have due *regard to the cost per pound of the available and actual potash* obtained, and we are not compelled to fear the comparative effect of the different forms which we may use; but in the case of the tobacco crop the introduction of one more requirement

(that it shall burn well) complicates the problem, and it is often the case that the form of potash which costs us the least per pound of actual potash is the one least desirable and economical.

The result of our investigation would lead us to divide soils, in relation to their desirability as tobacco producers. in connection with fertilizers, as follows:

First. New soils which have been newly cleared of their timber.

Second. Older soils to which nothing but barn-yard manure has been applied.

Third. Soils to which a mixture of barn-yard manure and commercial fertilizers have been applied.

Fourth. Soils to which no other application than commercial fertilizers have been applied; and that while it is true that the divisions between these classes is not distinct and plain, and that they lap over into each other, yet for our purpose they are sufficiently exact and plain.

With the first and second classes our investigation has nothing to do; and that with the fourth we have very little to do, for it seems to be a universally admitted fact that tobacco cannot be profitably grown in Pennsylvania by the use of commercial fertilizers alone; hence our investigation seems to be necessarily confined to the third class of soils.

As a nucleus or starting point we have the statement made at the meeting alluded to, that common salt (chloride of sodium), even in small amounts, would injure the burning quality of the leaf. This statement we find is supported by all of the practical evidence given at the meeting by practical growers who have communicated their views, and with the results obtained by practical experimenters, not only in this country, but also in Europe; hence we may fairly assume that common salt must not be used. Inasmuch as we know that some of the other forms of soda may be used with good effect, we may fairly assume that the injury in this case is due to the introduction of chlorine, and is not necessarily due to the soda. This view is supported by the fact that at the European Experiment stations the introduction of chlorine, in any form or combination. produces a similar effect, but that it is in combination with soda that it exercises its injurious effect to the greatest degree. At home and abroad it is admitted that the application of salt will, in nearly every case and on nearly all soil, produce an increase in the size and external qualities of the leaf, and that the use of four or five bushels of common salt per acre will increase the actual yield at a much less rate of cost per pound than almost any other application which can be made.

We find that in France and Germany the effect of different fertilizers upon tobacco has been made the subject of official examination. In France the government maintained an experiment station (under the care of the eminent experimenter and chemist, Schloesing), for the special purpose of tobacco culture and experiments relating thereunto. At this station the most careful tests were made, and the results given in a series of official reports. In one of these, when alluding to the effect of fertilizers upon the burning qualities of the crop, Schloesing writes as follows: "The burning quality is absolutely independent of the variety of tobacco, of the thickness of the leaf, of its strength, of its flavor and of climate. It stands in relation only to the proportion of potash salts to the vegetable acids contained in the

leaf, and consequently to the richness of the potash in the soil in which it grows."

From this we may infer that the results of Schloesing's experiments were such as convinced him that the effect was not so much due to the special form of potash used as to the relative proportion of potash and of vegetable acids in the leaf; that if there was an excess of certain acids in either soil or leaf, the effect of even the best form of potash would be neutralized and bad burning the result. To explain this result, let us suppose that potash is applied to the soil in the form of a high grade of sulphate, and after its application comes in contact with a surplus of unappropriated vegetable acid, an entire change of the nature of the compound takes place; a decomposition and a subsequent recomposition takes place, and we have entirely another form of potash formed. If this latter form is advantageous, good burning leaves are the result; but if, on the other hand, it be bad, then we have as a result a bad burning crop. These results, it must be remembered, are independent of anything which the grower can control, and are independent of what he may have applied in the form of a commercial fertilizer. The laboratory of nature has effectually undone the good effected in the laboratory of the chemist employed by the manufacturer of fertilizers, and the tobacco producer cannot control the result.

This train of argument evidently leads Schloesing to the following statement: "This theory of the combustibility of tobacco has been established by chemical analyses and by direct experiments in culture. The ashes of tobacco that burns well contain and yield to water carbonate of potash; those of badly burning tobacco contain little or no carbonate, but yield to water only sulphate or muriate of potash."

From this we may assume that the great desideratum is to get the potash into the leaf in combination with carbonic acid, and to avoid all combinations with sulphuric or muriatic acids. Then, says our theorist, we have only to apply it to the soil in the form of a carbonate, and our aim is accomplished. But again, the chemistry of nature interferes; the different acids combine with potash (as with other bases) with varying degrees of affinity or power. If, when combined with an acid—for which it has a weak affinity—it comes in contact (in the soil or otherwise) with a free acid, for which it has a stronger affinity, it at once forsakes its first combination and forms a new one. In this latter form (independent of its first form) it may be injurious and hurtful.

Schloesing further adds: "The carbonate of potash is, however, the result of the burning of malate, citric, tartarate and oxalate of potash, and the burning quality is therefore related to the presence of these salts in the tobacco. If enough of the above-named potash salts are incorporated with badly-burning tobacco, to give an ash containing a certain amount of carbonate of potash, the tobacco is thereby made to burn well. On the other hand, well-burning tobacco is made to burn badly by impregnating it with a certain proportion of sulphate or muriate of magnesia."

The effect of these salts is to convert the malate, citrate, tartarate and oxalate of potash into the corresponding lime or magnesia salts, so that on burning, the ashes contain their potash as sulphate or muriate, and contain no potash as carbonate, but carbonates of lime and magnesia.

In a cigar the fire is held by the charred tobacco. If this char be

compact, the fire easily goes out; but if it be light and porous, it continues to burn just as a compact lump of charcoal soon ceases to burn when taken from the fire, while an equal mass of pulverized charcoal burns away to ashes.

From this we may infer that, in the opinion of our author, the presence or absence of carbonate of potash is not due necessarily to its presence or absence in the fertilizer, but rather to the presence of the vegetable acids named, and that if these are not present in the soil—no matter how large the preponderance of carbonate of potash—the resulting crop will burn badly. That these acids are not supplied to any considerable degree by ordinary barn-yard manure is admitted; that they do not exist in commercial fertilizers is equally indisputable; therefore, it follows that they must exist in the soil; and by inference it follows that, if they are not present, no fertilizers can produce tobacco which burns well, and that its burning qualities will depend upon the extent to which they exist in the leaf.

In his report, Schloesing further states: "Now the oxalate, malate, citrate and tartarate of potash when heated, melt before they burn, and by further heating, yield an inflated, highly porous coal, favorable for holding fire; but the corresponding salts of magnesia give a compact coal which is easily extinguished."

This leads to the inference, that in order to secure good burning leaves, these acids must not only exist in the tobacco, but also that they must not be in contact with magnesia. We may also infer from this and other evidence submitted by Schloesing and Nessler, that the burning quality of tobacco is dependent, in reality, upon mechanical effects, which are, of course, produced by chemical causes; thus the good quality of the tobacco is dependent upon an "inflated and highly porous coal," while the reverse is due to a "coal which is easily extinguished." In corroboration of this, a series of careful experiments in the tobacco-growing regions of Connecticut leads to the statement in the experimental station report of that State, for the year 1884, that "mineral salts which fuse at the burning temperature—such as chlorides of potassium and sodium, and phosphates of potash and soda—hinder free burning. Fermentation, which reduces the quantity of sugar and albuminous matters, act on the whole to improve the burning quality. It would therefore seem that the burning quality is good or bad, according to the preponderance of favorable or unfavorable factors, and that it is always related in a simple manner to the composition of the ash."

Scientific investigation appears to prove that fertilizers, which, when first applied, are injuries to the burning qualities of the leaf, by modifications which they undergo in the laboratory of the soil, become so changed as to eventually give an excellent result. In corroboration of this Nessler and other experimenters corroborate the theory that in all cases of bad burning leaves, that portion near the midrib and the power of earliest formed leaves always burn worse, and that the burning quality always increase as we proceed either towards the latter or last formed leaves of the plant, it having been clearly shown that in some crops where the center of the leaves burned very badly the outer edges burned as well as could be wished.

In order that the reader may judge of the actual requirements of the tobacco crop when compared with other crops, we give the following table, which shows the number of pounds of each named ingredient contained in one thousand pounds of the crop when in an or-

dinary marketable condition; in order to carry out the comparison we have added an analysis showing the number of pounds of each in one thousand pounds of dry leaf tobacco:

PRODUCT.	Nitrogen.	Potash.	Lime.	Magnesia.	Phosphoric Acid.	Sulphric Acid.
Timothy,	13.5	20.3	4.7	1.9	6.9	1.7
Clover,	19.7	18.6	20.1	9.3	5.6	1.9
Green corn fodder,	1.9	3.7	1.4	1.1	1.0	0.3
Potatoes,	3.4	5.8	0.3	0.5	1.6	0.6
Wheat,	20.8	5.2	0.5	2.0	7.9	0.1
Rye,	17.6	5.8	0.5	2.0	8.5	0.2
Barley,	16.0	4.7	0.6	2.0	7.8	0.4
Oats,	19.2	4.8	1.0	1.9	6.8	0.5
Corn,	16.0	3.7	0.3	1.9	5.7	0.1
Wheat straw,	4.8	6.3	2.7	1.1	2.2	1.1
Barley straw,	6.4	10.7	8.3	1.2	1.9	1.8
Rye straw,	4.0	8.6	3.1	1.2	2.5	1.6
Corn fodder,	4.8	16.4	4.6	2.6	3.8	2.4
Oat straw,	5.6	16.3	4.3	2.3	2.8	2.0
Tobacco,	34.8	40.9	50.7	10.4	6.6	8.5

A reference to this table will show that a crop of fifteen hundred pounds of leaf tobacco removes from the soil about fifty-two and two-tenths pounds of nitrogen, sixty-one and four-tenths of potash, seventy-six and one-tenth of lime, fifteen and sixth-tenths of magnesia, nine and nine-tenths of phosphoric acid, and twelve and seven-tenths of sulphuric acid. When compared with an ordinary crop of corn, in which the fodder is returned to the field through the barnyard, we note that the tobacco is very largely in excess in the amount of potash (nearly ten to one) removed from the soil; hence the inference that all special fertilizers for tobacco should be rich in potash; in like manner we find that the tobacco crop takes a large excess (when compared with corn) of nitrogen, and hence we find tobacco fertilizers rich in this element also; but when we compare the phosphoric acid of the corn crop with that of the tobacco we find the proportion reversed, and that the corn requires the most; hence tobacco fertilizers run low in phosphoric acid.

In connection with the fact that common salt injures the burning quality of tobacco, we find that, after long experience and careful experiments, slaughter house offal and fish scrap have the same effect, while on the other hand Peruvian guano and cotton seed meal have the opposite effect. To this fact we may look for many of the failures in the use of commercial fertilizers on the tobacco crop; very many of them derive their whole stock of nitrogen from slaughter house offal, blood, meat and fish pomace.

At the North Carolina Experiment station much care has been given to experiments with various fertilizers for this crop, and after being tested in a number of cases not only on the station farm, but also among practical growers in different parts of the State, and upon divers soils, the following mixture has been strongly recommended: "To one thousand pounds of stable manure or mould, add the following, carefully mixing and composting them: Sulphate of potash, three

hundred pounds; sulphate of ammonia, one hundred pounds; sulphate of magnesia, one hundred pounds; dissolved bone, four hundred pounds, and land plaster (gypsum), one hundred pounds, making in all two thousand pounds."

In Connecticut the following mixture has for several years been submitted to a practical test and found successful: "Fifteen pounds of bone dust, eight pounds of sulphuric acid, thirty-one pounds of carbonate of potash, five pounds of carbonate of soda, twenty-five pounds of carbonate of magnesia, and sixty pounds of carbonate of lime; the acid, when mixed with double its weight of water is to be slowly added to the bone dust, and the other ingredients added to dry the mixture." We would suggest that instead of the ground bone and acid, it will be less trouble to use twenty-five pounds of some reliable brand of dissolved bone, and thus avoid the trouble of handling the acid.

In referring to the plan of compounding special fertilizers for tobacco, one of our leading fertilizer manufacturers writes us as follows:

"Our analysis is eight and a half to nine and a half of phosphoric acid, five and a half to six and a half of potash, and three and a half to four and a half of ammonia; the phosphoric acid we obtain by dissolving thirteen hundred pounds of bone (animal) and adding two hundred and seventy-five pounds of high grade sulphate of potash (ninty eight per cent.) with less than three per cent. of chlorine, and we use nitrate of soda of sulphate of ammonia to bring up the ammonia, and add one hundred and fifty pounds of plaster which is mixed with the ammonia salts; no chlorine or salt of any kind enters into our goods to prevent the proper burning of the leaf and make it rough; we use nothing but sulphate in the best form; there is no doubt in my mind that potash derived from a vegetable source, is better because it is more easily dissolved and contains no salt."

One of the largest manufacturers of fertilizers in the State thus refers to the character of the proper fertilizer for tobacco, and also to the effect of fertilizers upon the crop:

"Several years ago our attention was called by prominent tobacco buyers in Hartford, Conn., and Lancaster, Pa., to the almost universal decline in the quality of domestic cigar leaf tobacco, and particularly to its lack of free burning properties.

"The introduction and use of Sumatra leaf for wrappers followed this complaint, and one of the most potent arguments used by the cigar manufacturers before Congress against an increase of duty on Sumatra tobacco was emphasized in their petition, as follows: 'No increase in the tariff on Sumatra tobacco will establish an arbitrary monopoly. The introduction of it here was necessitated by the continual decline in the quality of our domestic leaf.'

"These complaints, coming from sources not to be disregarded, induced us to carefully inquire into the cause which lead to this falling off.

"The first observation established this fact: That though it was possible to grow an equal number of pounds of tobacco year after year upon the same ground which had been amply covered with stable manure, the qualities which distinguished the first crop were lacking in the others. The leaf grew rank and coarse, but cured badly, and choked in burning. The texture was no longer tough and elastic, and the color was variable. Good buyers neglected it, and it ceased bringing a fair price in the market.

"In other words, barn yard manure did not supply the elements which were evidently exhausted from the virgin soil by the first crops.

"Again it was noticed that those commercial fertilizers specially prepared for use on cereal crops, and which also promoted a vigorous growth of cigar leaf tobacco, did not improve it in respect to its burning, color, nor texture. An analysis of the ashes of a cigar revealed mineral elements different from the ashes of wheat, rye, oats, etc., and from this it was clearly evident that what was suited to the one was not quite the right manure to perfect the other. Therefore, the disappointment which followed the application of fertilizers that had proved useful to wheat, and yet had not helped the quality of seed-leaf tobacco gave rise to the prejudice against them for the latter purpose.

"Now, whilst it requires equal care and labor to grow an acre of coarse, thick-leaved tobacco, and another of fine texture and free-burning properties—the one commanding but a few cents per pound in the market, and the other sought for at the highest rates—it is well to consider what manures shall be applied to effect this essential improvement in value.

"The foundation of all efforts to arrest the degeneracy of seed-leaf tobacco must be laid upon a full appreciation of the fact, that the impairment or absence of certain mineral constituents in the soil affect its growth, and that it cannot live a healthy life or perfect all its parts without them. Prof. J. F. W. Johnson remarks, that 'a soil on which one crop cannot attain to maturity may yet surely and completely ripen another; therefore, it is as much the end of an enlightened agricultural practice to provide for the various requirements of each crop in regard to inorganic food as it is to endeavor to enrich the land with purely vegetable substances.'

"An analysis of the soils of those famous tobacco lands of Vuelta de Abajo, Cuba, and San Diego, Brazil, discloses the presence of certain inorganic substances foreign to those particular localities, whilst their exact counterparts are found in the ashes of tobacco grown there. Now, as these lands have been cropped with tobacco continuously for over one hundred years, it is plainly evident that as much pains is taken to renew those peculiar mineral elements as there has been care used to supply organic food to the plants.

"It is well known to manufacturers and smokers how the leaf assimilates with certain manures, and the rank odors of hog-dung and Menhaden fish follow it into the cigar and the pipe. Again, how greedily it absorbs saline particles, that if even manured with the product of salt marsh hay the crop will be ruined for smoking purposes.

"Mr. John Fendrick, of Columbia, Pa., told the writer he would not buy tobacco where he knew the smallest quantity of salt had been used with the manures, as its presence could be detected in all stages of curing and manufacture, and that cigars made from it were universally condemned.

"In view of these circumstances, as much care must be taken in excluding deleterious matter from a tobacco fertilizer as in furnishing those which add to the desirable smoking qualities of the weed.

"In the south of France, where the celebrated St. Omer tobacco is grown, its cultivation is permitted only in certain departments, the soil and manures being carefully analyzed, and cultivation prohibited where these do not possess the constituents necessary for the growth of good tobacco.

"For all of these reasons, our efforts have been directed towards perfecting a fertilizer that will not only grow tobacco, but improve it, believing if the growing plant can incorporate into its leaves those substances which impart disagreeable odors, or those which render them brittle when cured and choke their pores after fermentation, it is likewise capable of absorbing those which will produce the opposite effects.

"We have advanced with great caution and tried our new brand on the crop of 1886 on different soils in Lancaster and Chester counties, but always in the same fields where other fertilizers were employed, to institute an intelligent comparison of its value with the rest.

"Its effect on the plants was strictly watched from the time of its application till the leaves were stripped from the stalks, and the results may be briefly summed up as follows, viz: Every plant on which it was used grew vigorously from the start without checking, and was fully ripe inside of sixty days from the date of planting. The leaves were uniformly fine, of large growth, elastic, splendid color and entirely free from spots or white veins.

"Simply as a rapid grower it was a perfect success, and in all cases matured the leaves from ten to fifteen days in advance of those depending upon barn-yard manure or other fertilizers for support, thus insuring their safety from the hail storms and droughts of late summer.

"Although the dry weather which prevailed through the fall was unfavorable to curing, the crops grown by it maintained their superiority over others in color and texture. and when comparative samples were shown to the tobacco dealers they pronounced them worth five cents per pound more than the average crop.

"These samples are now undergoing the sweating process, to determine the enhanced value of the free burning properties given to the leaf by this fertilizer.

"It is our intention to trace these samples through all the stages of fermentation and re-sweating into the hands of cigar manufacturers and consumers.

"While we feel assured that these investigations will further demonstrate the peculiar adaptability of this fertilizer to all these needful points of tobacco culture. we are, as before stated, proceeding cautiously, and before definitely asserting superior claims of excellence we want to allow the fullest range of our experiments over varieties of soils and seasons.

"We have too much at stake to proceed faster than is warranted by such a range of experience. The disappointment which has too often followed bold assertions we do not want to react upon us.

"We earnestly hope, for the good of our own State, that our fertilizer will speedily produce wrapper leaves equal to the best imported stock. If it should, however, prove a general failure, we shall be glad to welcome any fertilizer that will produce the sadly-needed improvement and a full success."

The practical tobacco growers whose names are attached to their communications have furnished us with the following notes on tobacco culture and the effect of different fertilizers upon the crop. Want of space has compelled us in several cases to condense the communication:

H. M. Mayer, Rohrerstown, Pa.: "My experience in the use of commercial fertilizers is limited. I used it one year on tobacco; six hundred and fifty pounds to the acre; paid thirty-eight dollars per ton

I raised a good crop, but received no benefit above that where I applied nothing but barn-yard manure. Therefore I had nothing for the commercial fertilizer; so I quit using it. I had applied lime and barn-yard manure in large quantities a few years prior to the commercial fertilizer; used manure with the commercial fertilizer. I was always most successful in raising the best tobacco in new or virgin soil, and I find it the case nearly everywhere where the soil is good that virgin soil brings the best crop of tobacco. It is not always the soil that produces the largest crop of corn or wheat that will produce a good crop of tobacco. Where tobacco has been grown in large quantities per acre for a few years consecutively, then ceased to produce tobacco scarcely sufficient to pay for the labor, and is then followed by a wheat crop, the straw would be too rank to produce good wheat. What new soil contains above what we call old soil I am not able to explain; but it has something that is essential in tobacco. So far as the burning qualities of tobacco are concerned, I have noticed that salt and fatty substances cause it to burn dark."

D. B. Landis, Lancaster, Pa.: "Having lived in a tobacco growing district (East Hempfield township), I naturally saw and learned some of the results from a use of commercial fertilizers.

"Barn-yard manure, as a matter of course, is largely used in that locality as a fertilizer, although other commercial products have been and are extensively substituted where it is possible to do so to advantage.

"Lime was one of the first fertilizers other than ordinary manure tried on this soil. Many farmers still adhere to its use in the growing of tobacco. Some growers claim their soil dries out too much where lime is used, and in consequence use it moderately or in conjunction with stable manure. Others think lime is just the article for their tobacco fields. Outside of manure, lime is more sought after as a fertilizer in my native township than any other product.

"Some years since fossil marl was experimented with by a few farmers. It worked nicely in some instances when dropped at every spot where a tobacco plant was put. Plants grew rapidly and matured well. Several growers, however, did not have any noticeable satisfactory results. They thought the marl was not adapted to their soil. No large amount of this fertilizer is used at the present time.

"Various other fertilizers have been more or less successfully used in the growing of the weed. Baugh's, of Philadelphia, perhaps as much as any other, is used to some extent here.

"In my varied experience of observation (and especially during the years of 1883 to 1886, when, as editor of the Landisville *Vigil*, I was brought into contact with the most successful tobacco raisers of the section), I have learned that it pays to use commercial fertilizers on all crops. Tobacco farming land to-day averages from two hundred and fifty dollars to three hundred and fifty dollars per acre as a result from the constant use of soil strengtheners. Barn-yard manure generally works the best here on all crops of a rank growth—*i. e.*, tobacco, corn and vegetables. Other fertilizers work admirably on potatoes, wheat, &c."

James Collins, Quarryville, Pa.: "The first tobacco grown by me was that of 1856. I then used hog manure and lime. I have always had the best crops with hog manure; have used fertilizers in connection with manure and lime. I prefer to plow the hog manure down under a stiff sod, roll the ground well and mark out as for corn, sowing

the fertilizer in the furrows and the ridge up over it with a corn-scraper, then roll to make the ridges compact. I have used a number of different kinds of fertilizers, all of which served to give the young plants a good start and keep them growing until they reach the hog manure under the sod. I have used dissolved South Carolina rock with good effect, and for its cost (fifteen dollars per ton) it gives me the best return for the outlay. I am of the opinion that the burning qualities of the tobacco are but little affected by the fertilizer. The manner of curing has, in my opinion, much more effect than has the fertilizer. The crop should be ripe when cut, and not dried too fast; should be hung in the shade, and not placed too close on the poles. The faster it grows, in my experience, the better it cures."

Casper Hiller, Conestoga, Pa.: In reply to your inquiry about commercial fertilizers, their effects, &c., on tobacco:

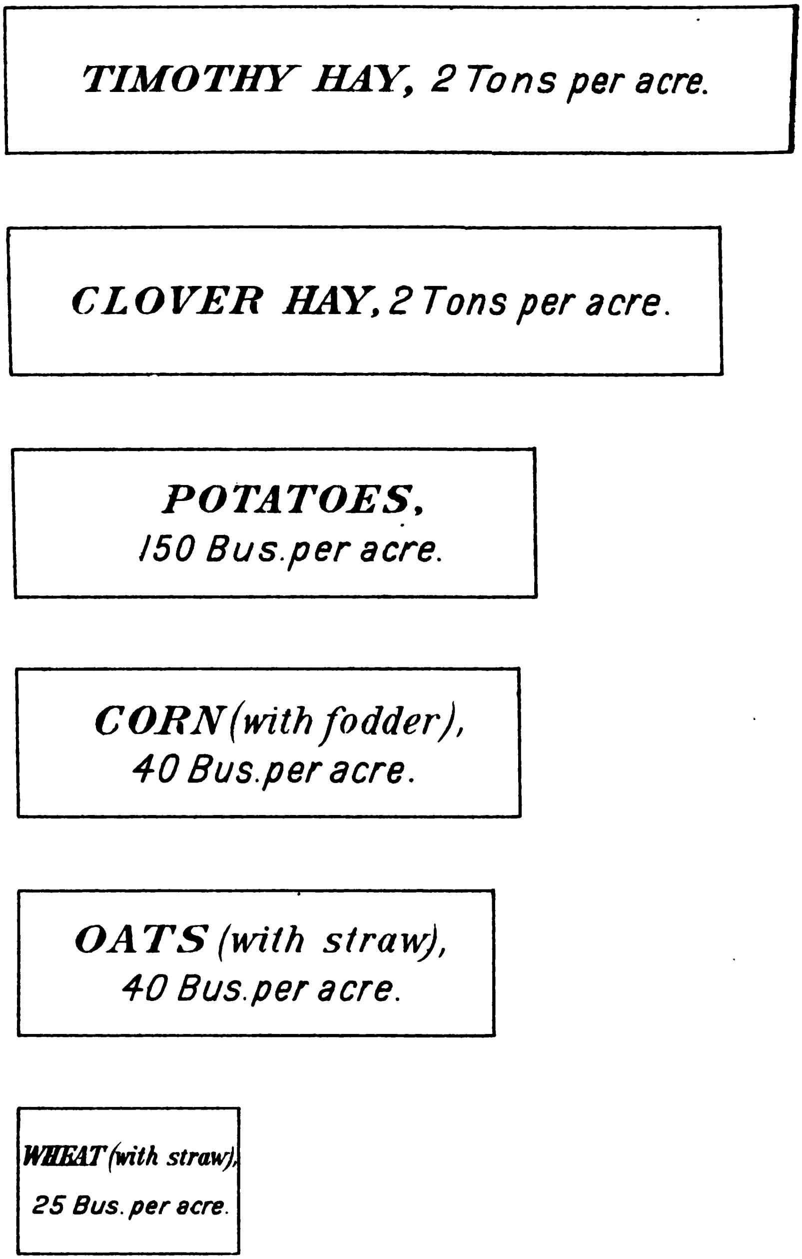
"Some years ago some one said that lime slacked with salt-water made a valuable fertilizer. I applied some of it to a tobacco crop, and thereby learned that salt was injurious to the crop, both in the curing of it and in its smoking quality, especially the latter. Cigars made from it burned into a black ash, and smokers decidedly objected to them. Manufacturers find fault with crops raised exclusively by commercial fertilizers. The potash from kainite and muriate of potash and the nitrogen from nitrate of soda are the manurial elements in commercial fertilizers, as well as they are in barn-yard manure, but kainite, muriate of potash and nitrogen of soda as used in the make-up of commercial fertilizers contain from fifty to eighty-five per cent. of extraneous matter. A good dressing of stable manure is twenty tons to the acre. In these twenty tons there are about two hundred pounds of potash and about one hundred and sixty pounds of nitrogen. Sixteen hundred pounds of kainite would be required to produce the same amount of potash and eight hundred pounds of nitrate of soda furnish the nitrogen.

"If I am correct in this statement, then we are applying two thousand pounds of this extraneous matter to the acre, and it appears very evident that therein lay the elements that are injuring the quality of tobacco. How much of it is common salt?"

S. G. Hubbard, of the Northeast Homestead writes as follows:

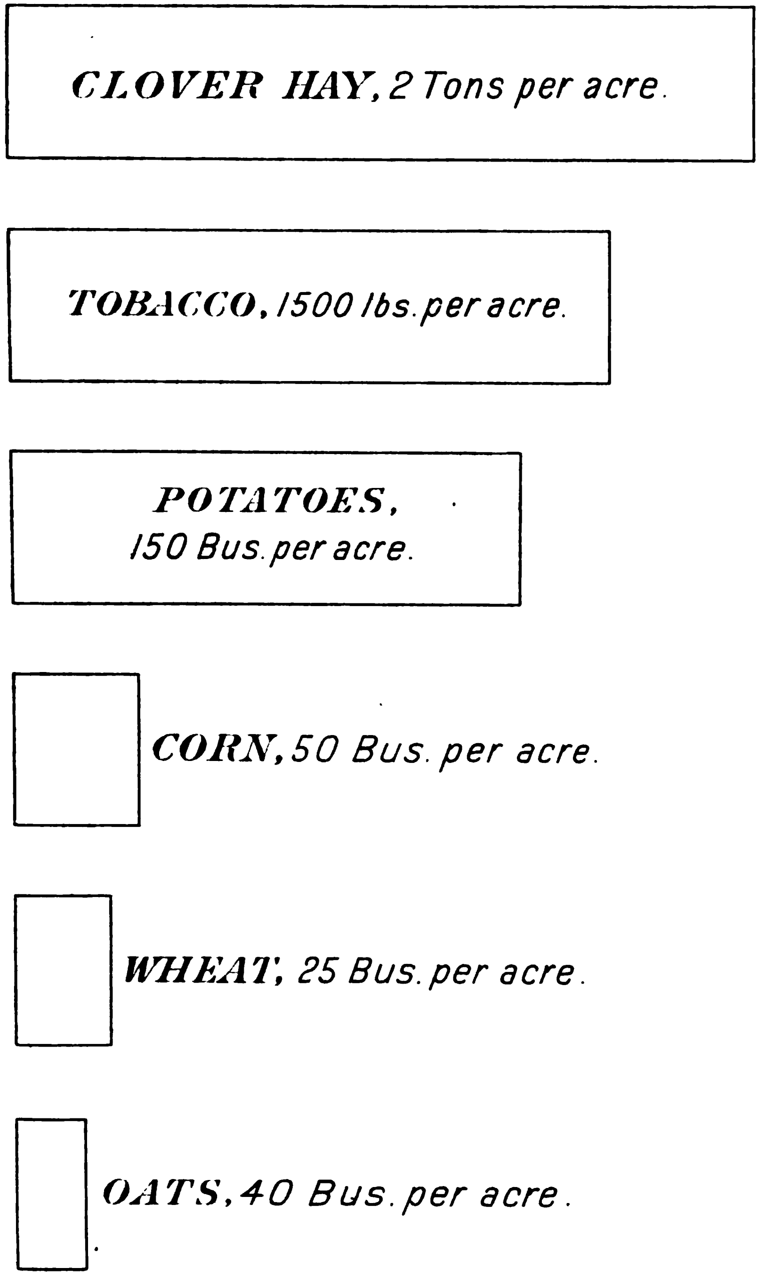
"I have investigated the questions involved with considerable care, seeking to know, if possible, the bottom facts about fertilization. An experience of thirty-five years as a grower—a part of the time a buyer and jobber of leaf among the manufacturers—has given abundant opportunity for observation and practical knowledge of the difficulties in the way of successful production by the farmer, and the qualities required in leaf to satisfy the manufacturers of cigars.

"In common with other young farmers, I started with the idea that stable manure was the 'sine qua non' of tobacco production. After a succession of four years' cropping on the same lot, it was found that manure was failing to produce the same good results as before. Peruvian guano was tried, and it produced astonishing results as a fertilizer for several years. Therefore it was concluded that stable manure alone did not furnish the quantity of nitrogen required by tobacco and that a combination of both would be sufficient for all the requirements of the plant. After a few years it was observed that the quality of the leaf and quantity of pounds per acre had greatly deteriorated. Whole fields were spotted with brindle or calico plants. Rust would appear and spread rapidly over the field, and it would present a very un-



COMPARATIVE EXHAUSTION OF POTASH.

The whole crop being removed.



COMPARATIVE EXHAUSTION OF POTASH

The straw & fodder being returned to the soil.

healthy appearance. Guano had failed to produce its former good results, and stable manure failed to restore health to the plants.

"It now began to dawn upon the farmers that tobacco possibly required some other elements of plant food which stable manure and guano did not furnish in sufficient quantities. The problem was finally solved, and the credit is due to science. The chemical analysis of tobacco showed it to contain as leading elements in its composition, lime, potash, nitrogen and sulphuric acid. This knowledge led to a most careful and systematic line of experiment. The soil was supplied with all the elements of plant food required. Experiments have been carried on in that line by a few farmers in the Connecticut valley which they claim have been crowned with success.

"As a general thing, these are modest men who mind their own business and do not write for the press. Competent judges of tobacco, dealers and manufacturers, have seen and tested their goods and pronounce them to compare favorably with the best grown in the Connecticut valley. The sales of tobacco so grown, for several years past, including the 1886 crop, in the advanced prices received from dealers and manufacturers furnish still better proof of successful experiment of growing good tobacco without manure. It is claimed that the following important results have been reached by this system of fertilization:

"*First.* It is known how to obtain a perfect burn, in which respect most of the tobacco as formerly raised was more or less deficient.

"*Second.* We get a more perfect and healthful plant grown, as shown in its greater freedom from rust and other defects in the field.

"*Third.* The leaf is of finer texture, improved color and a more glossy surface.

"These essential qualities of tobacco are only found in good leaf. They have been produced for several years in succession by this system of artificial fertilization. The inexperienced farmer is never sure of a perfect growth and development of leaf under the old haphazard system with manure and fertilizers.

"Our friends, the New York dealers, who are so generous with their advice to farmers, know very well that the introduction of Sumatra tobacco introduced a new fashion, and created a new standard for wrappers in the trade, greatly differing from that of seven years ago. Tested by that new standard, what were called the fine seed-leaf wrappers of twenty years ago, would now be condemned by most manufacturers as unsuitable for wrappers."

Several of our correspondents have suggested that a solution of the problem might readily be found by an analysis of two samples of leaf tobacco, one of which burned well and the other badly, and that this analysis would show the presence or absence of the special ingredients which caused the trouble; at the meeting of the Lancaster County Agricultural Society the same theory was advanced. We therefore offer the results of a number of careful analyses of the two kinds of leaves alluded to (good and bad burning) taken from the reports of the Connecticut Experiment station; they are as follows:

Composition of Crude Ash of Tobacco Leaf.—No. 1.

	BURN WELL.							BURN BADLY.
	Sweated.				Unsweated.			Sweated.
	1	2	3	4	5	6	7	8
Sand and soil insoluble in acids and silica, ...	25.10	3.65	7.75	19.50	4.52	5.80	7.90	8.20
Oxide iron and alumina, ...	1.63	.20	.35	1.25	.28	.22	.96	.81
Lime, ...	21.80	23.92	24.30	19.61	23.57	22.25	25.23	19.32
Magnesia, ...	5.08	6.84	5.44	12.10	8.71	8.57	6.48	7.27
Potash, ...	15.13	28.18	25.72	18.22	26.02	26.50	23.20	28.29
Soda, ...	.29	.30	.37	.59	.29	.15	.42	.11
Phosphoric acid, .	1.92	3.65	3.46	2.05	2.14	2.18	2.24	1.79
Sulphuric acid, . .	3.05	3.93	4.53	4.08	5.99	6.62	3.98	4.31
Carbonic acid,. . .	16.20	23.30	24.96	16.20	22.54	20.50	21.40	19.40
Chlorine, ...	5.43	4.08	.89	4.72	4.12	5.58	6.30	7.62
Carbon, ...	3.55	1.21	1.56	1.66	.98	2.05	1.94	2.35
Water, ...	1.90	1.10	.80	1.14	.90	1.10	1.30	2.16
	101.08	100.36	100.13	101.12	100.06	101.02	101.35	101.63
Oxygen equivalent to chlorine, .	1.22	.92	.20	1.06	.93	1.25	1.42	1.72
	99.86	99.44	99.93	100.06	99.03	99.77	99.93	99.91

Composition of Pure Ash.—No. 2.

	BURN WELL.							BURN BADLY.
•	Sweated.				Unsweated.			Sweated.
	1	2	3	4	5	6	7	8
Oxide iron and alumina, ...	3.04	.28	.54	2.01	.39	.31	1.42	1.12
Lime, ...	40.66	33.76	37.34	31.81	33.18	31.62	37.16	28.38
Magnesia, ...	9.47	9.66	8.36	19.80	12.26	12.18	9.54	10.67
Potash, ...	28.21	39.76	39.48	29.42	36.62	37.57	34.69	41.54
Soda, ...	.54	.42	1.11	.94	.40	.21	.61	.17
Phosphoric acid, .	3.58	5.15	5.31	3.31	3.01	3.10	3.30	2.62
Sulphuric acid, . .	5.69	5.55	6.95	6.60	8.43	9.41	5.86	6.31
Chlorine, ...	10.13	5.76	1.36	7.65	5.80	7.93	9.28	11.19
	101.32	100.34	100.45	101.54	100.09	102.45	101.34	102.05
Oxygen equivalent to chlorine, .	2.28	1.30	.31	1.72	1.31	1.79	2.09	2.52
	99.04	99.04	100.14	99.82	98.78	100.66	99.25	99.53
Pure ash, per cent.	13.80	14.38	17.99	17.74	16.25	16.80	14.58	18.08

Per Cent. of Ash Ingredients in Water Free Tobacco Leaf.—No. 3.

	Burn Well.							Burn Badly.
	Sweated.				Unsweated.			Sweated.
	Cuba.	Sum.	Wis.	Conn.	Conn.	Conn.	Conn.	Conn.
	1	2	3	4	5	6	7	8
Sand, soil and silica,	6.49	.74	2.15	5.62	1.03	1.25	1.71	2.19
Oxide of iron and alumina,	.42	.04	.10	.36	.06	.05	.21	.22
Lime (CaO),	5.65	4.86	6.76	5.65	5.39	5.25	5.45	5.15
Magnesia (MgO),	1.32	1.39	1.51	3.48	1.99	2.02	1.40	1.94
Potash (K_2O),	3.92	5.73	7.16	5.25	5.95	6.26	5.02	7.54
Soda (Na_2O),	.08	.06	.10	.17	.06	.04	.09	.03
Phosphoric acid (P_2O_5),	.49	.74	.95	.59	.49	.52	.48	.48
Sulphuric acid (SO_3),	.79	.80	1.26	1.18	1.36	1.56	.86	1.15
Carbonic acid (CO_2),	4.19	4.73	6.95	4.67	5.16	4.84	4.63	5.17
Chlorine,	1.40	.83	.25	1.36	.94	1.32	1.36	2.03
Carbon,	.92	.25	.43	.48	.23	.48	.42	.63
Water,	.49	.22	.22	.33	.21	.25	.28	.58
	26.16	20.39	27.84	29.14	22.87	23.84	21.91	27.11
Oxygen equivalent to chlorine,	.31	.18	.05	.30	.21	.29	.30	.45
Summing up of analysis,	25.85	20.20	27.79	28.84	22.66	23.55	21.61	26.66
Total crude ash, per cent.	25.89	20.32	27.74	28.84	22.88	23.62	21.62	26.65
Potash carb. in ash sol. in water,	1.37	5.23	7.60	2.91	4.54	4.29	3.46	4.74

These tables present an analysis of the *same samples* in three different forms. viz: 1, as crude ash or the leaves in their natural condition burned at a heat but little above redness and containing sand, &c., which adhered to them; 2, in which sand, carbon and water have been removed leaving in the ash the soil food of the plant, and 3, the ash of the water free leaf; the third table also shows the place at which the leaf was produced.

A number of our correspondents having suggested that chlorine is alone to blame for the bad burning qualities of tobacco, it may be interesting to note the effect the facts presented in these tables have upon this theory. In table No. 2 we note that the specimen having the greatest amount of chlorine (10.13) was one of the best burners; this was also the case with sample No. 3, which contained the least. Some have claimed that bad burning was due to a deficiency of potash but our table shows that sample No. 8 contained the largest amount of potash and was at the same time one of the worst burners; on the other hand, sample No. 1, containing the least potash, was the best burner; in fact, after carefully examining the table, item by item, we fail to find that the presence or absence of any one ingredient has in any way effected the burning qualities of the leaf.

In his excellent report on "The Chemistry of American Tobaccos" (see volume III of the tenth census), Dr. G. E. Moore, thus alludes to the causes which affect the burning qualities of tobacco:

"*First.* The soluble part of the ash of a combustible tobacco always contains potassium carbonate (tobacco contains, according to Schloesing, no sodium); or, in general, a tobacco is more combustible the more alkaline the ash.

"*Second.* The soluble part of the ash of a difficultly combustible tobacco contains *not* potassium carbonate; it ordinarily contains lime, whence it follows, that in the combustible tobaccos, the quantity of potash exceeds in equivalent proportion that of the sulphuric acid and chlorine, and that in difficultly combustible tobaccos the reverse is the case.

"*Third.* A difficultly combustible tobacco becomes combustible if the potassium salts of an organic acid (malic, citric, tartaric, oxalic, &c.,) be added thereto in such quantity that the potash in the salt exceeds in equivalent proportions the sulphuric acid and chlorine.

"*Fourth.* A combustible tobacco becomes difficultly combustible if a mineral salt (sulphate or chlorine of calcium, magnesium or ammonia, &c.,) be added in such quantity that the sulphuric acid and chlorine exceed in equivalent proportions the potash of the ash."

Schloesing, in referring to the same subject, writes, as follows: "I have observed that the alkaline salts of malic, citric, oxalic, pectic and tartaric acids, when heated in close vessels, swell up strongly, without doubt, because they melt in decomposing and leave a very voluminous coal that possesses little solidity and is very porous, while lime salts under the same circumstances do not alter in volume and leave a very compact and coherent coal. Now every one knows that a porous coal remains longer incandescent than a compact one. On the other hand, if we examine the combustion of tobacco (*i. e.* a cigar), we will observe that the action of heat produces two classes of effects. Volatile substances (smoke) and coal are formed, which latter chiefly sustains the combustion, as it burns as it forms. If a cigar contains enough of those salts which, when ignited, swell up while decomposing, it will leave a porous coal throughout, and will contain little or no organic potash salts but only sulphate or chlorine, consequently 'hold fire' a long time. If, on the other hand, the cigar neither of which plays any role in the combustion, and if the malic, citric, &c., acids are combined with lime, the constituents of the tobacco do not swell up in burning, but leave a compact coal, which does not remain long incandescent. In the latter case the cigar carbonizes and the resulting coal shows the structure of the leaf. Will not say that in a difficultly combustible tobacco there are no organic potash salts, that all the potash is in the form of sulphate and chlorine, but only that the combustibility of tobacco is independent of its thickness, porosity, ripeness and composition. A tobacco therefore burns well if it contains enough organic potash salts; it burns badly or not at all if it contains too little, and the presence of carbonate of potash in the ash is a sign of the good combustibility of the tobacco, as its absence is a sign of incombustibility."

Conclusion.

After collecting all of the evidence which we have been able to obtain by correspondence with the practical tobacco growers of our State; after carefully going over the acknowledged authorities; after carefully collating all the evidence thus found, we incline to the opinion that the bad burning qualities of tobacco are due to causes which are not directly related to the fertilizers which are used, nor to

the soil upon which it is planted, but rather to a combination of these two sources, by which, by the uniting of certain substances in the fertilizer with certain acids in the soil, compounds find their way into the leaf, which exercises a direct and positive influence upon their burning qualities. That is if certain acids exist in the soil they may, and often will, neutralize the effects of the best commercial fertilizer which can be employed.

That the burning qualities of the tobacco depend upon the presence not only of potash, but also of potash in combination with certain acids not found in our fertilizers, and that these acids (in combination with potash as a base) exercise their effect and power by the nature of the ash which they form.

That the fact that if poor burning tobacco be moistened with any of the vegetable acids named by Schloesing, in combination with potash, its burning value is increased and brought up to a maximum, seems to prove that in order to produce a good burning article, the potash (no matter in what form it is applied) must, at some time during its passage from the soil or fertilizer to the plant, come in contact with these acids, and that their affinity for potash is so great that they will break up its combination with other acids (as carbonic and sulphuric), and thus form the necessary compounds.

The muriatic acid and chlorine in some unexplained way effect the form of the potash as it exists in the plant, and if applied to the soil, even in small amounts, more or less injure the combustibility of the product; but these are cases in which this rule does not hold good, but they are so few as to scarcely affect the rule.

That any fertilizer, the nitrogen of which is derived from meat, blood, fish. scrap or animal matter, will more or less affect the burning quality of the leaf and injuriously affect its odor and flavor.

That as a supplement to yard manure we have nothing more trustworthy than dissolved bone (animal) or acidulated South Carolina rock mixed with a high grade of potash salt, and that in the present condition of our market, there is nothing better than high grade sulphate of potash for this purpose.

That while the addition of nitrogen (ammonia) may, in many cases, benefit the crop, yet inasmuch as this ingredient is the most expensive of the three (being valued at seventeen cents per pound), its addition is often made at so great a cost as to destroy the margin for profit.

That an ordinary application of fifteen tons of yard manure per acre will furnish all of the nitrogen required by an ordinary crop, and that the addition of more, otherwise than in a more available form, is not profitable.

That it is profitable to use from three hundred to six hundred pounds of a well compounded commercial fertilizer per acre, in addition to a fair coat of yard manure, and that the value of this commercial fertilizer greatly depends upon the availability of its potash, nitrogen and phosphoric acid, its main duty and effect being to push the plants forward until they can utilize the yard manure, or until the latter becomes sufficiently decomposed to be readily available.

That with less barn-yard manure and a greater amount of the proper commercial fertilizer, the actual quality of our tobacco may be raised, although the ultimate effect will be to decrease the weight per acre. No doubt this latter defect will be fully supplemented by the increased value per pound of the product.

That it is not always safe to value the crop in accordance with the

number of pounds per acre, but that its quality is also an important factor which is too often overlooked.

RECENT INVESTIGATIONS ON THE NITROGEN OF SOILS AND PLANTS.

By Professor WILLIAM FREAR, *State College, Centre county, Pa.*

There has probably been no question of greater interest to scientific agriculturists than the "nitrogen question," and none to the solution of which more earnest and prolonged effort has been devoted.

Value of Nitrogen in Annual Product of United States.

The immense economic interests involved may be realized when it is stated that the annual agricultural product of the United States contains 13,000,000,000 pounds of nitrogen, worth at eighteen cents per pound, $2,340,000,000; of this, it is estimated that the exports, less the amounts brought into the country in the agricultural imports, contain one-tenth.* A knowledge of the immediate sources from which crops obtain this essential and valuable constituent, the form in which it exerts the most favorable influence upon plant development, the means by which it can be most fully and profitably returned to the soil for the use of succeeding crops, the sources of loss and the means of averting or compensating for it, must, therefore, be admitted to be of the highest and most practical economic value.

Controversy Concerning the Assimilation of Free Nitrogen.

The chief controversy has centered about the question of the assimilation by plants of atmospheric nitrogen, excluding that present in the form of ammonia and nitrous and nitric acids, concerning the assimilation of which by leaves or root, there has been no dispute. Priestley was early led to the belief that plants do assimilate free atmospheric nitrogen. De Saussure, twenty years later, after more elaborate investigations arrived at the opposite conclusion. Boussingault, in 1837–8, made experiments which led him to adopt Priestley's conclusion. Ville, in 1849–52, made experiments which pointed in the same direction. But, in 1851–5, Boussingault † conducted experiments from which he found that plants receiving air containing nitrogen only in a free state, did not live, while others, exposed under exactly the same conditions, but receiving also nitrogen in combined form, grew vigorously. Finally, Dr. Pugh, the first president of what is now the Penn-

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* Dr. H. W. Wiley, Proc. A. A. A. S., 1886, p. 135.
Dr. Wiley gives the following figures for the amounts of nitrogen per acre contained in the *average* American staple crops; they are as follows:

	Pounds per acre.
Wheat,	18.45
Corn,	43.82
Oats,	28.02
Barley,	31.33
Rye,	20.30
Buckwheat,	20.14
Hay,	28.80

These figures include the amounts in both hay and straw. It will be remembered that the figures are not nearly high enough to represent the amounts contained in a heavy crop.

† Agronomie, Chimie Agricole, et Physiologie, I, pp. 1–64.

sylvania State College, associated himself with Sir John Lawes and Dr. Gilbert, at Rothamsted, England, for the purpose of submitting the question to experiment under such conditions that all points in dispute might be tested. After most careful and elaborate experiments upon both cereal and leguminous plants, these distinguished scientists announced* as the result of their investigations, that free nitrogen is not assimilated by plants.

Theory of Lawes, Gilbert and Pugh.

As a result of these investigations the large majority of agricultural chemists and plant physiologists accepted it as an established fact, that the vegetable growth of the world must depend for its nitrogen upon the amount already present in the soil, in addition to the relatively small amounts absorbed by the soil or plant as ammonia from the atmosphere, or brought down as ammonia and nitrous and nitric acids in the dew, rain and snow. It was admitted that there is a considerable difference between the food habits of cereals and of the clovers, or legumes, but the ability of the latter to grow consecutively on the same soil for years without aid from artificial supplies of nitrogen, and their failure, in most instances, to respond to the application of nitrogenous manures, was regarded as preëminently due to a difference in root habit, and not to any power of the latter plants to assimilate free nitrogen. It was known that the insoluble nitrogenous constituents of the soil are not assimilable in any considerable measure by the cereals and true grasses, but it was thought possible that the legumes, including the clovers, might be able to attack and assimilate these insoluble compounds, which alway form the large proportion of the nitrogenous matter of soils. Nor was it overlooked that there are drains upon soil nitrogen other than that of the nitrogen contained in the part of the crops removed and not returned as manure to the soil. Especially prominent was the loss by sub-soil drainage, in consequence of which our rivers annually pour immense quantities of valuable constituents into the sea.† Upon striking a careful balance the adherents of this school must admit that *under agricultural conditions* the loss is greater than the gain, or in other words, that we are living upon nitrogen supplies stored up during previous ages, and that this reserve is being surely and steadily exhausted even where the most careful farming is practiced.

Ville's Theory.

A few investigators, however, including Prof. Ville, who has, in a measure, become their recognized leader, have stoutly maintained that, while cereal crops may not assimilate free nitrogen, leguminous crops certainly obtain from the air a part of their supply beyond that obtained as ammonia and nitrous and nitric acids. They admit the usefulness of nitrogenous fertilizers for true grasses and cereals, and even for leguminous plants before their leaves are developed, but not for the latter stages of their growth. They hold, therefore, that by the introduction in proper measure of leguminous crops into a rotation, the soil—including both surface and sub-soil—may not only be preserved from depletion in its supply of nitrogen, but may even be absolutely enriched.

*Phil. Trans. 1851, II, pp. 431–579.

† It has been calculated that the Rhine discharges daily 220 tons of saltpetre into the ocean, the Seine 270 tons and the Nile 1,100 tons. (Storer, Agriculture, I, p. 318.) The amount discharged by the Mississippi has been estimated as high as 2,000 tons.

In recent years the study of the sources of loss and gain of the nitrogen of soils and plants, has been busily resumed, new methods of investigation have been introduced and many facts unearthed which, while they shed some light upon the main object of research, show that there are many complexities involved that render this subject one of the most difficult known to the modern investigator. So numerous have been these modern investigations and so intricately connected one with another, that it is impossible in this connection to make any detailed reference to them individually. I shall merely attempt a brief *resumè* of the most important facts known concerning the nitrogen supplies at the command of the plant, and indicate, as well as I can, the results of modern investigation.

The primary sources of plant nitrogen are the atmosphere and the soil.

Forms of Atmospheric Nitrogen.

The atmosphere over each acre of the globe weighs about 32,000 tons, of which 28,000 tons is nitrogen. This *free nitrogen* is, however, very inert, and is attacked with difficulty by our most powerful chemical agencies, so that all the numerous attempts which have been made to force it to contribute to our supplies of artificial fertilizers have thus far been futile.

The atmosphere contains, in addition to free nitrogen, certain *nitrogenous compounds*, ammonia, nitrous and nitric acids. In addition to the amount of combined nitrogen received by the atmosphere from the soil in ways to be noted later, these bodies may be produced by slow combustion, in the presence of ozone and peroxide of hydrogen, and directly or indirectly through the agency of electricity, chiefly the silent discharge; under "slow combustion" should be included the processes of fermentation and decay.

Nitrogen Compounds in Rain Water.

The principal points to which attention in this connection should be directed, are the amounts of these substances present in the atmosphere and those precipitated in the atmospheric waters—rain, snow and dew. Ville's researches,* which were very carefully made, lead to the conclusion that, while the amount of ammonia in the air varies greatly, it is, on the average, equal to one part, by weight, in 50,000,000, or 1.28 pounds per acre.

The amount of nitrogen in the form of nitrous and nitric acid has not been so fully determined, but is generally considerably less.

The importance to vegetation of these highly diffused compounds will be touched upon later.

The amount of combined nitrogen precipitated in the atmospheric waters—rain, snow and dew—has been carefully determined on different parts of the globe, and, as might be expected, has been found to vary considerably at different times and in different places, both in absolute quantity and in the relative proportion of the different constituent compounds. From the analysis of the water collected in the $\frac{1}{1000}$ acre rain gauge at Rothamsted, England, Warington † computes that $2\frac{1}{2}$ pounds per annum of ammonia nitrogen are deposited upon each acre of soil in that locality, and that 1 pound of nitrogen in the form of nitric acid, and 1 pound in the form of nitrogenous organic matter accom-

* Recherches sur la Vegetation, Paris, 1853.
† Storer, Agriculture, I, pp. 349–50.

pany it, thus making a total of 4½ pounds per acre per annum. Earlier observations, with less accurate analytical methods, gave in 1855, 7 pounds, and in 1856, 9½ pounds of ammonia per acre, the water amounting to about 600,000 gallons. German observers obtained 6⅛ and 9⅞ pounds of ammonia, the amounts of water being 400,000 and 500,000 gallons. Kellner, Sawano, Yoskii and Makino * found about 2.2 pounds of nitrogen per acre in the annual rainfall at Tokio. The proportion of ammonia to nitric acid was very similar to that observed at Rothamsted.

These figures show that the amounts of nitrogen contributed by the atmospheric waters to the soil, are very insufficient for the maintenance of fertility under agricultural conditions.

Amount of Soil Nitrogen.

Turning now to the soil, let us first note the total amount of nitrogen present. It is scarcely safe to attempt any general statement, owing to the immense variations in different soils, some sands being almost destitute of nitrogen, while cultivated soils and peats often contain it in large quantity. Krocker† showed that cultivated soils rarely contain less than 3,500 pounds per acre. A. Müller found, on the average, in surface soils poor in lime, 9,100 pounds and in the subsoil 5,200. In several instances he found 31,000—33,000 pounds. Boussingault found 6,000—30,000 pounds in good loams from various localities, taken to a depth of seventeen inches.

Amount of Ammonia in Soils.

Recent investigations have thrown considerable light upon the real character of this soil nitrogen. It was formerly supposed that a considerable proportion existed in a soluble form as ammonia, either free or in combination with some organic acid. But the re-agents used in the old methods of analysis, in addition to driving off the ammonia nitrogen, also broke up organic compounds and added their nitrogen, in the form of ammonia, to that originally present as ammonia; by substituting other reagents, it has been discovered that only .0006 per cent. of ammonia is present, on the average, in soils; that is, about twenty-one pounds per acre, while many soils have less, and very rich soils five to ten times as much.‡

Amount of Nitric Acid in Soils.

The amount of nitric acid in the soil is even more variable than that of ammonia, and in the same soil is constantly changing, owing to causes to be mentioned later. In many light soils, poor in humus, it is never large, while in rich garden soils Boussingault has observed a variation in the course of the summer months from twenty-five to eight hundred pounds per acre. §

Other Soluble Nitrogen Compounds in Soils.

It is well known that soils immediately after treatment with large quantities of stable manure, contain considerable quantities of soluble, nitrogenous compounds, other than those above mentioned, and

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* Landwirthschaftliche Jahrbücher 15 (1886), 701-11; Biedermann's Centralblatt für Agrikulturchemie, 15, 793-5.
† Storer, Agriculture, I, 410.
‡ Ib., I, pp. 351-52.
§ Ib., I, p. 314.

numerous experiments* tend to show that many of these compounds are directly assimilable by the plant. Johnson and others have long inferred from the results of their analyses, that similar bodies are always formed in the soil during the decay of organic matter, and are always present at least in small quantity. Warington† has recently shown their presence in small quantities in several fertile soils, and Baumann‡ calls attention to the fact, that in the soils of forests, and especially in the "black earth" of Russia, there are considerable quantities of matters exhibiting similar properties.§

Proportion of Soluble to Insoluble Nitrogenous Compounds in Soils.

It is obvious, however, that the absolute quantity of soluble nitrogenous matter in the soil at any one time, is so small that, even if none were leached out by natural drainage, the supply would soon be exhausted, unless some more important additions were made to the stock than that of the amount coming in the rain water. As has been noted before, it has been considered as almost certain, that certain large classes of plants, including grasses and cereals, cannot to any considerable extent, feed upon the insoluble nitrogenous matter of the soil, and it has been earnestly disputed whether any green-leaved plants have that power. Leaving the discussion of the latter point, for the present, attention is directed to means by which this material may be prepared for the use of the plant without its intervention.

Preparation of Insoluble Nitrogen for Plant Use.

As was stated above, Boussingault observed a very great variation in the amounts of nitric acid in the soil at different seasons. It was formerly supposed that this nitric acid was formed by the direct chemical union of atmospheric oxygen with the ammonia formed during decay. Many careful investigators were, however, unable to produce nitric acid by the oxidation of ammonia under the conditions existing in the soil and water, and they began to suspect that its formation must be the result of a process more complex than had at first been supposed. Without attempting to enter into details, it may be stated that among the most recent investigators Celli and Marino-Zuco,‖ Frank,¶ Uffelmann** and Kœnig†† maintain that nitric acid may be formed in soil or water by the direct oxidation of ammonia, but even they admit that, in general, much the greater proportion of nitric acid must have been formed in some other manner. By the researches of numerous investigators it has been found that nitrification in soils and waters is very largely, if not wholly, due to the action of a ferment or ferments. Although many have contributed to our knowledge of this important process, Schloesing and Muntz‡‡ may very rightly claim the first honors, and Warington,§§ Berthelot, Deherain, Joulie and

* Cameron, Landwirthschaftliche Versuchs-Stationen Organ, **8**, 235; Hampe, ib. **17**, 8–9; Wolf, ib, **10**, 13; Baessler, ib. **31**, 231–40; Jour. of the Chem. Soc., 1886, Ab. 1061, P. Wagner, Journal f. Landwirthschaft, 1869. Knop, Chem. Centralblatt, 1866, 774.

† Chemical News, **55**, 27; Berichte d. Deutsch. Chem. Gesellschaft, 1887, Ref., p. 98.

‡ Landwirth. Vers. Stat., **33**, 301–3.

§ Cf. also, Berthelot and André, Comptes rendus, **103**, 1101–4; Jour. Chem. Soc. 1887, Ab., p. 292.

‖ Atti d. Acc. Lincei, Rudet. 519–23, 1886; Ber. Deut. Chem. Gesellschaft, Ref., 1886, 818.

¶ Landwirthschaftl. Vers. Stat., **33**. 464.

** Chem. Centralblatt, 1886, 312–3; Biedermann's Centralblatt, **15**, 362–3.

†† Landwirthschaftl. Vers. Stat., **33**, 467–8.

‡‡ Comptes rendus, **84** (1877) 301 *seq.*; 891 *seq.*, and 1074 *seq.*

§§ Jour. Chem. Soc., 1879, 429 *seq.*; **45**, 637 *seq.*, and 1885, Tr., p. 758 *seq.*

many others are very prominent. So numerous have been the researches upon the phenomena attendant upon this fermentation that it will be impossible to do more than sum up the results in a very brief manner.

Character of the Ferment.

There has been some discussion upon the character of the organism producing this fermentation, and some have urged that the oxidizing effect may be due to a number of similar species,* but the majority attribute it to the action of a single, special ferment, which has been isolated. This ferment, placed in appropriate liquids, increases at first slowly, and afterward rapidly. Upon sowing the proper nutritive solutions with ordinary soil, there is first observed a transformation of the nitrogenous matter into ammonia, unless the nitrogen is already present in that form.† Ladureau is inclined to attribute this transformation to the action of a special ferment differing from that producing nitric acid. After the formation of ammonia has begun, nitrates are formed as the first oxidation products; possibly, as Warington is inclined to believe, through the activity of another special ferment; and finally, the nitric fermentation proper sets in. Schloesing and Muntz found that exposure to a temperature of 212° F. for ten minutes killed the organism, and 195° was highly detrimental; on the other hand, its activity was slight below 54°, and most vigorous at about 81°; that, therefore, nitrification practically ceases during winter. Dessication of a soil almost entirely stopped the action of the ferment. Free access of oxygen was essential for its oxidizing action. When air is shut off from the soil, the processes going on in the latter are greatly changed in character, as would be readily imagined from the circumstance just mentioned. The depth from which a soil sample is taken exerts an important influence on the activity of the ferment contained. Warington stated recently‡ that the ferment is always found at the depth of two feet, but with less frequency and in a much less vigorous condition until a depth of six feet was reached. The subsoil nitrogen proved to be readily nitrifiable when freely exposed to the air. The evidence of the lysimeter gauge is against the formation of any large quantities of nitrates in the subsoil. One twenty inches deep gave annually 40.2 pounds per acre, of nitrates in the drainage water; forty inches deep, 35 pounds; sixty inches, 38.8 pounds. Kellner. Sawano, Yoskii and Makino§ found that soil taken at a greater depth than twenty inches did not set up a nitric fermentation in dilute urine. The presence of a certain amount of carbonaceous matter seems necessary to nitric fermentation, but this amount may be very small;‖ Laurent finds the richest soils most favorable to nitrification.¶ Schloesing and Muntz found that sugar, glycerine, alcohol and other organic bodies, may replace the carbonaceous bodies of the soil, but Munro shows that they may prove favorable to fermentations detrimental to nitrification, and it seems probable that certain compounds in green plants, freshly plowed under, may have to undergo a preliminary decay before they are fit for the action of the nitric ferment.

* Cf. Adametz, Botan. Centralb, **39**, 36, Ann. agronomiques, **13**, 138.
† Cf. Munro. J. H. M., Jour. Chem. Soc., 1886, 632–681.
‡ Jour. Chem. Soc., 1887, Tr., 118–129.
§ Landwirthschaftl. Jahrbuch, **15**, 712–5; Bied. Centralb., **15**, 812–3.
‖ Munro, Jour. Chem. Soc., 1886, Tr., 632 *seq.*
¶ Bulletin Acad. roy. Belgique, [3], **11**, No. 2; Annales agronomiques, **12**, 342.

It is found that a faint alkalinity is also a necessary condition, but Warington has shown that an excess of ammonium carbonate will stop the activity of the ferment, and that it is resumed upon the addition of gypsum, upon the addition of which sulphate of ammonia and carbonate of lime are formed. The presence of a base such as lime, with which the acid may unite as it forms, is another necessary condition, but an excess of caustic lime stops the process; carbonate of lime, on the other hand, may be favorable. Baumann* in summing up his observations upon the effect of the character of the soil upon the degree of nitrification says: "The amount of nitrates in unfertilized, uncropped soils is comparatively small; nitrification is much less in soils rich in humus than in those containing little. Nitrates are best developed in lime soils, poor in humus; less freely in sands and loams. In an uncultivated soil bearing forest growth, it is impossible to find nitric acid." Warington has shown that clover roots favor the distribution of the nitric ferment in the subsoil; Deherain † has indicated the probability that the stirring of the soil by cultivation, thus causing fresh contact as well as greater access of oxygen, is favorable to a great increase in nitrification; Soyka has ‡ shown that the ferment may be distributed by the capillary movement of water. Wollny § has shown an intimate connection between the development of carbonic acid and that of nitric acid during the decay of the organic matters of the soil. Professors Miles‖ and Storer¶ have emphasized the practical importance of a knowledge of these facts in order that we may draw most effectively and profitably upon the nitrogen reserve of our soils.

In addition to the nitric ferment, with its solvent action upon the insoluble, nitrogenous, organic matters of the soil, another possible intermediary remains to be noticed. B. Frank** calls attention to the fact that the oaks, beeches, birches, pines, spruces, larches, firs and other forest trees are in great degree destitute of the root-hairs which play so important a part in the life activity of most plants, but that the rootlets are covered with a thick growth of mould, the filaments of which are most intimately woven into the young, woody tissues. This mould is found upon the roots of yearling growths, as well as upon the older trees, and is more abundant as the soil is richer in humus. It is well known that moulds live upon the elaborated compounds in the humus, including the insoluble, nitrogenous organic matters, and Frank believes that in these cases the mould gives up to the rootlets the food which it has prepared in a soluble form, thus acting as a purveyor to the tree. This observation is interesting in connection with Baumann's statement that nitrates, which are known to be the principal nitrogenous food of plants, are absent from forest soils.

Direct Gain of Nitrogen by the Soil.

Having considered the means by which the insoluble, nitrogenous organic matters of the soil may be rendered available for those plants

* Landwirthsch. Vers. St. **33**, 301–2.
† Annales agronomiques, **12**, 17–24.
‡ Prag. med. Wochenschrift, 1885, No. 25; Wollny's Forschung. Agricultur-physik, **8**, 373; Ann. agronomiques, **12**, 342.
§ Jour. f. Landwirthschaft, **34** (1886), 213–320; Bied. Centralblatt, **16**, 1–11.
‖ Agricultural Science, **1**, 103,
¶ Agriculture, Vol. I.
** Nachrichten a. d. Klub der Landwirth der Berlin, 1886, No. 180, p. 1296; Biedermann's Centralblatt, **15**, 296–7.

unable to use them in their insoluble form, let us direct our attention to the recent studies upon the direct gain of nitrogen by soils without any intervention on the part of the plant.

There has been an animated discussion over the power of the soil to absorb ammonia and the conditions of such absorption, some maintaining that the absorption is purely physical, and others that it is in great measure chemical. It probably partakes in varying degrees of both characters. The physical absorption must precede the chemical, and as fast as ammonia enters into chemical combination in the soil a fresh amount pushes in from the surrounding atmosphere, so that the tension of the ammonia vapor in the free atmosphere and in the interstices of the soil is constantly equalized. It must be admitted that the testimony of experiments is as yet very conflicting, and there is much uncertainty, to say the least, concerning the conditions of absorption. It seems probable that the ammonia enters into insoluble combination chiefly as double humates and silicates, and is not readily leached out from the soil. Wipprecht* found that wet clay contains more ammonia than dry. The amount increases with the duration of exposure. When water is evaporated from the clay, ammonia is also lost; but more ammonia is absorbed with a given weight of water than is lost with it. The practical importance of the thorough aeration of the soil is thus indicated. Acting upon the supposition that ammonia is being constantly absorbed by and chemically united with the soil, it is possible to approximate the maximum amount available in any given time to a given area by exposing during that period a vessel of known area containing sulphuric acid, and finally determining the amount of ammonium sulphate formed. Kellner,† Sawano, Yoskii and Makino found that there was absorbed in this manner at Tokio 10.5 pounds per acre per annum.

Absorption of Nitrogenous Acids.

It seems certain that any free nitric acid in the atmosphere can combine with the soil with which it comes in contact, and that there may also be a double decomposition, by which the nitrites and nitrates of the atmosphere may yield their nitrogen acids to the soil. By a method similar to that used for ammonia, the above mentioned investigators have determined the amount of nitrogen in the form of nitric and nitrous acids absorbed in carbonate of potash It was found to be 1.16 pounds per acre per annum, making a total of 11.67 pounds of nitrogen absorbed directly by the soil. It is interesting to recall that only 2.2 pounds of combined nitrogen was brought to the soil of that locality in the rain-water.‡

Fixation of Free Nitrogen in the Soil.

The investigations of recent years seem to indicate that not only the ammonia and nitrogen acids of the atmosphere may contribute to the stock of soil nitrogen, but that the free nitrogen may also add to it, and without the intervention of plant life; further, that there are at least two agencies assisting in this *fixation*, as it is technically termed.

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* Agricultural Science, **1**, 106.
† Landwirthschaftl. Jahrbuch, **15**, 701-11: Bied. Centralblatt, **15**, 793-5.
‡ Cf. Heinrichs, Forschung, a. d. Geb. d. Agrikultur-physik, **4**, 446; Schloesing, Comptes Renders, **82**, 1105; Atwater, American Chem. Jour., **6**, No. 6.

It was observed by the Thenards, and their observations were extended and confirmed by Berthelot,* that nitrogen may be fixed upon vegetable matter, such, for example, as cellulose, through the agency of electricity, even of low potential. It seems probable that, as there is a constant disturbance of electrical equilibrium at the surface of the earth, this agency may be of very considerable importance in its relation in the fixation of soil nitrogen.

Early observations of De Saussure, Faraday, Mulder, Boussingault, Cloëz, and Koenig and Kiesow† indicate the probability that, under certain circumstances, free nitrogen may unite directly with organic matter, and it was thought probable that the hydrogen evolved during decay united directly with the atmospheric nitrogen to form ammonia. Armsby,‡ in experimenting upon the loss of nitrogen from decaying organic matter, found "that decaying organic substances in the presence of caustic alkali are able to fix free nitrogen without the gain being manifest as nitric acid or ammonia, and probably without the formation of these bodies. Selmi found that a little ammonia is formed during the evolution of hydrogen by moulds and fungi. Deherain found that humus fixes a little nitrogen on exposure to the air, as well as in an atmosphere of pure hydrogen. Simon also made the same observation, though Sostegni§ directly disputes his results. The most elaborate investigations into this subject are, however, those of Berthelot.‖ After experiments with uncropped clay and sandy soils under various conditions of exposure, this investigator arrived at the conclusion that free nitrogen is fixed upon the organic matter of soils through the agency of a special ferment; that this process is entirely independent of nitrification. The conditions under which it is most active are, in some respects, those most favorable to nitrification, though the experiments of Mulder and Deherain seem to indicate that the fixation is best accomplished in the presence of limited supplies of oxygen or in the deeper layers of the soil. This process is scarcely noticeable in winter. Berthelot found that, on the average, twenty-five pounds of nitrogen per acre were fixed during the summer season, and unhesitatingly affirms that this process by which the soil gets its principal nitrogen supply.

Direct Losses of Nitrogen by the Soil.

Having observed the several processes tending to increase the nitrogen supply of the soil, let us now note briefly some of the means by which it is diminished.

It is an unsettled point whether much ammonia is lost from the soil by evaporation. Berthelot maintaining that there is, and Schlœsing,¶ on the other hand, that there is a constant gain.

There is, however, no dispute that there is a considerable loss of nitrates from all soils by drainage; varying, of course, with the abundance of the nitrates in the soil and the amount of drainage

* Ann. chim. phys., **10**, 52, and **12**, 457.
† Cf. Storer, Agriculture, I, 448–450.
‡ American Journal of Science, 1874, (3), **8**, 337.
§ Landw. Vers. Stat., **32**, 10–11.
‖ Bull. Soc. Chim. **14**, 121 *seq.*; Comptes rendus, **102**, 1886, No. 17; ib. **101**, 775–784; **104**, 205–209 and 625–630; Ber. Deut. Chem. Gesellschaft, 1885, Ref. 669; ib., 1887, Ref. 98; Annales agronomiques, **12**, 42–43; Biedermann's Centralblatt, **15**, 92–4.
¶ Comptes rendus, 1886, Nos. 17, 18, 20, 22–5.

water. Kellner,* Sawano, Yoskii and Makino, and also Berthelot,† assert that this loss is greater than the total gain from atmospheric waters. The relatively greater proportion of the nitrates lost in this manner is strongly indicated by Deberain‡ in discussing the results of his own investigations and those of Lawes, Gilbert and Warington. According to the latter observations the loss was sometimes equal to the amount obtained in the crop. Indeed, Lawes and Gilbert state distinctly that they recover in their crops only one-half to one-third of the nitrogen applied as fertilizer.

Liberation of Free Nitrogen by the Soil.

There is, moreover, still another source of loss to the soils, viz: the liberation of free nitrogen. Notwithstanding Ehrenberg's§ recent statements to the contrary, it seems certain from the numerous investigations of Reiset,‖ Joulie, Armsby and many others, that free nitrogen is always given off during putrefactive fermentation. Indeed, Müller¶ asserts that it is given off even during the nitrification of the ammonia of urine in the presence of alcohol and wood ashes. It always occurs, as Schlœsing** remarked, when a soil is subjected to fermentation with limited supplies of air. His observations were confirmed by those of Deherain and Maquenne,†† Munro,‡‡ Wollny§§ and Springer‖‖. Strecker¶¶ states, as the result of certain pot cultures, that there is a loss of nitrogen from all uncropped soils—sands and loams—which is diminished when the soil is stirred or shaded. Gayon and Dupetit,*** after a careful study of *denitrification*, or the reduction of nitrates to ammonia and free nitrogen, are led to attribute it to the action of two special ferments, but this limitation of the reducing action is disputed. It is well known that this process constantly occurs in soils to which air has not free access, as in poorly drained lands.

Relation of Plants to Loss and Gain of Nitrogen.

Having noted the relations of the air and soil to the nitrogen supply, it remains to notice what new variations may be introduced with plant growth.

Absorption of Ammonia by Leaves.

It is placed beyond dispute that the leafy portions of plants do absorb ammonia directly from the atmosphere, and Grandeau††† intimates that the leaf with its acid juices may absorb ammonia like an acid solution; but, as Atwater‡‡‡ very well remarks, it seems improb-

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* Landw. Jahrbuch, **15**, 1801-11; Bied Centralb, **15**, 793-5.
† Comptes rendus, **104**, 205-9; Ber. D. Chem. Gesellsch. 1887, R. 98.
‡ Annales agronomiques, **12**, 97-112.
§ Zeitsch Physiolog. Chem. **11**, 145-179; Jour. Chem. Soc., 1887, Ab., 172.
‖ Cf. Reiset, Comptes rendus, **42**, 53: Ville, ib. **43**, 143, König and Kiesoow, Landw. Jahrbuch, 1873, 107; Armsby, Am. Jour. Science, [3] **8**, 337; Dietzell, Biedermann's Centralblatt, 1882, 417; Reder, ib. 1884, 652; Morgan, Landw. Vers. Stat., **30**, 199 and 429; Kellner, ib. **32**, 57.
¶ Landw. Vers. Stat., **32**, 285-300; Jour. Chem. Soc., 1886, Ab., 399.
** Comptes rendus, **77**, 203 and 353.
†† Ib., **95**, 691, 732 and 854.
‡‡ Jour. Chem. Soc., 1886, Tr., 632-681.
§§ Jour. f. Land. **34**, 213-320; Biedermann's Centralb., **16**, 1-11.
‖‖ Proc. Am. Assoc. for the Adv. of Science, **18**, 172; Am. Chem. Jour., **4**, 412.
¶¶ Jour. f. Landw., **34**, 1-82; Bied. Centralb., **16**, 73-80.
*** Comptes rendus, **95**, 644 *seq*; Jour. Pharm. Chem., 1886, July, pp. 34-5.
††† Nutrition de la Plante, pp. 574-8
‡‡‡ Am. Chem. Jour. **6**, No. 6.

able that such an absorption should contribute very largely to the nitrogen supply of the plant.

Loss of Nitrogen by Plants.

The early experiments to which allusion has already been made, of Boussingault and of Lawes, Gilbert and Pugh, indicating that free nitrogen is not taken up directly by the plant, have recently been corroborated by the careful experiments of Deherain and Maquenne,* and these latter experiments also indicate that free nitrogen is not ordinarily evolved, at least from the mature plant.

From the investigations of Boussingault,† Lawes, Gilbert and Pugh,‡ Hellriegel,§ Schultz‖ and Day,¶ it seems that there is in many cases a loss of nitrogen during germination of the seeds. Recent experiments upon peas by Atwater and Rockwood,** show a loss during this period, and during a long period afterward when the plant was grown without a supply of nitrogenous food.

The indications seem, therefore, to warrant the statement that there is no satisfactory, direct evidence of any considerable direct absorption of nitrogen from the atmosphere by the plant, but that it is probable that some nitrogen may be lost during germination; and during the immediately ensuing period, if the plant is insufficiently nourished.

Action of Enriching Crops.

As was remarked at the beginning of this paper, there is practically no claim that cereals and true grasses are able to draw their nitrogen supplies directly from the atmosphere, and the whole dispute turns upon the claim of that power for the enriching crops, including chiefly the leguminous plants. The classic researches of Voelcker long since demonstrated, that in spite of the fact that the clover crop removed more nitrogen from the soil than most crops do, it leaves the surface soil richer in this ingredient than it was before. Lawes and Gilbert supposed that owing to the deep root habit of the plant, and the immense network of roots left in the surface soil, this enrichment is largely due to the removal of subsoil nitrogen to the surface. Warington showed that nitrification was active at greater depths during the growth of clover, so that more nitrates are formed. Miles suggests that their root residues may also be more readily nitrifiable than those crops. Heiden has found that not only is the surface soil enriched by the growth of clover, *but also the subsoil.*

As has been noted previously, it has long been supposed that these plants possess the power of using that insoluble portion of the nitrogenous organic matter of the soil which is unavailable to other crops. Laws and Gilbert have urged that these crops, as well as others, use large quantities of nitrates, and have pointed to the increased nitrification attendant upon their growth, as a provision for the large needs of the crop; they also found upon investigation, that both soil and subsoil were poorer in nitrates after the growth of clover. Recently, however, Dr. Gilbert * was obliged to admit that cases sometimes oc-

* Ann. agronom. **12**, 192.
† Ann. chim. phys., [2], **67**, 5.
‡ Phil. Trans., 1861, II., 499.
§ Jour. prak. Chem., **64**, 190 and 167.
‖ Ib, 1862, 126.
¶ Jour. Chem Soc., 1880, Trans., 646.
** Am. Chem. Jour., **3**, 327–43.
†† Landw. Vers. Stat., **33**, 467–8.

curred in which the supply of nitrates did not seem great enough to meet the demand, and that it seemed probable that these plants must have other sources of supply. Hellriegel * states as the result of his experiments, that the *Gramineæ*, *Cruciferæ*, *Chenopodiaceæ*, and *Polygoniaceæ* develop in proportion to the supply of nitrates furnished, other conditions being equal and normal, but that this is not true of the *Papilionaceæ*,—the sub-family to which the clover, beans, peas and similar plants belong. He observed the development of little tubercles upon the roots of the members of this sub-family, and found that after their development the addition of nitrogenous fertilizers, which up to that period had been beneficial, produced little effect; he observed also that the vigor of the plant's subsequent development was proportional to the development of these tubercles; hence he inferred that they may act as agents in the utilization of the insoluble organic matter of the soil or in the fixation of free nitrogen. Professor E. von Wolff † states that his experiments tend to confirm Hellriegel's results. Recently it has been stated as the result of experiment, that papilionaceous plants fertilized with large quantities of nitrates do not develop these tubercles, and that they develop more as the supply of nitrates is less.

Relations of Ozone and Electricity Generated by the Plant, to the Gain of Nitrogen.

There may be mentioned in this connection two ingenious theories of plant assimilation: (1) That the ozone generated in relatively larger quantities by the leafy legumes, oxidizes more ammonia, and so increases the proportion of nitrates in the atmosphere immediately in contact with the soil upon which these crops are grown. (2) That the leaves, acting as an electric element, fix nitrogen upon their own cellulose, the more as they are larger and more abundant.

Finally, there remain to be noticed the results of a few culture experiments bearing upon the subject under consideration.

Joulie‡ found a gain of nitrogen in the case of a mixture of ray-grass and clover grown in pots, and also in the case of buckwheat, though the gain was less in the latter instance. He found that the addition of lime without sufficient potash and phosphoric acid, and of stable manure and dried blood seemed least favorable to the accumulation. Instead, however, of attributing the fixation of nitrogen to the action of microbes, he questions whether the plant cells may not rather be regarded as the agents exercising that function.

Atwater§ found that in the case of peas grown by water culture there was a decided gain in nitrogen, greatest when the conditions were most favorable to growth, or, in other words, when the plant was well supplied with plant food in a form not too concentrated.

Strecker, ‖ after careful pot culture of oats and lupines, asserts that the latter leguminous plant is not more enriching than the cereal oats; that there can be a gain in nitrogen only by plants growing on very poor soils and possessing the power to take up very small quantities of nitrogen at a time; that in many cases there is a loss rather than a gain.

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* Landw. Vers. Stat., **33**, 464–5.
† Ib.
‡ Ann. agronom., **12**, 5–16; Bied. Centralb., **15**, 511–3.
§ Am. Chem. Jour., **6**, No. 6; **8**, 327 and 398.
‖ Jour. f. Landwirth., **34**, 1–82; Bied. Centralb., **16**, 73–83.

Berthelot,* experimenting to determine the effect of plant growth upon the gain of nitrogen in the soil, asserts that while there may be a gain during natural vegetation, the growth of the higher plants, especially under the conditions of cultivation, is accompanied by a loss of nitrogen, and that this tends to outbalance the gain arising from the direct fixation of this element in the soil.

Deherain,† commenting upon the gain in nitrogen of a soil standing in pasture, as compared with the loss observed in the same land when cropped, as it had previously been, with beets and maize, notwithstanding the fact that larger amounts of nitrogen were removed in the grass crop, calls attention to the fact, that not only was the loss of nitrates from the pasture soil diminished by reason of the diminished activity of the nitrifying organisms, and the increased assimilation of the nitrates present, by reason of the longer period of growth of this vegetation; but that by diffusion through subsoil waters and capillary action, such a crop may gain access to, and assimilate a portion of the relatively more abundant nitrates of neighboring cultivated soil.

The mass of evidence at our command is summarized by Wiley,‡ in in the following paragraphs:

1. The combined nitrogen which is the product of vegetable and organic life forms the chief source of nitrogen for the growing plant.

2. Before it is assimilable by the plant it undergoes a process of oxidation which is due solely to a living organism.

3. The nitrates thus formed are absorbed by the plant, and the albuminoids are formed from the nitric nitrogen by a process of reduction. The nitrates themselves are subject to the action of a ferment by which deoxidation takes place and free nitrogen and nitrous oxide are evolved.

4. The diminution in quantity of available nitrogen thus supplied, is restored by the fixation of free nitrogen by the action of organisms in the soil, or by the oxidation of free nitrogen by the interior cells of the plants acting in a manner analogous to the nitric ferment in the soil, or by the oxidation of free nitrogen by electrical discharges or by combustion.

5. The quantity of combined nitrogen brought to the soil and growing plant by rainwater and the atmosphere, arising from the last two phenomena, is an inconsiderable amount when compared with the whole weight required by the growing crop.

LIME AND HOME-MADE FERTILIZERS vs. COMMERCIAL FERTILIZERS.

By HON. C. C. MUSSELMAN, *member from Somerset.*

The subject assigned to me naturally demands an argumentative style, and could be more properly given in the form of a report. Even if I had the ability, the subject before us does not admit of the spread-eagle style. It will be given in the language of a plain, practical farmer.

The matter here presented is, "Lime and Home-made Fertilizers,

* Comptes rendus. **104**, 625-30; Ber. Deut. Chem. Ges., 1887, Ref. 289.
† Ann. agronom, **12**, 17-24; Bied. Centralb., **15**, 436-8.
‡ Proc. Am. Assoc. Adv. of Science, 1886, p. 158.

against Commercial Fertilizers." This is plainly a Commonwealth case, in which every citizen in the great State of Pennsylvania is interested, directly or indirectly. And, as a member of this Board, it becomes my duty to make this information to this grand inquest, the State Board of Agriculture.

It is scarcely necessary to mention that I am not a lawyer, and consequently, cannot promise to be very formal. You can expect facts and figures rather than law and technicalities; and truth rather than poetry. In justice to all concerned, let me say in the outset, that this prosecution is only intended for the guilty, and not for the innocent, who do an honest and a legitimate business.

It will be proven, to the satisfaction of every disinterested and unprejudiced mind, that there is at least something very wrong in this great scramble for the gain that is derived from the manufacture and sale of these high-sounding fertilizers.

According to the annual report of the State Board of Agriculture, there were sold in Pennsylvania during the last year 478 different brands of commercial fertilizers. This number, those brands not reported and those introduced since then will swell the figures to very nearly the round sum of 500.

That the sale of many of these superlatively high-sounding fertilizers are an imposition, and others a down-right fraud, will be shown by the following facts and figures: By an actual count in the annual report of 1883, about two-thirds of all the different commercial fertilizers then offered for sale sold for more than their true value. Very few, comparatively speaking, were sold below their reported commercial value. Many brands were sold at three times their commercial value. Still others were sold, and are yet imposed upon innocent farmers, at a high price, which have very little, and some actually no value at all, according to the tabular list of analyses, being injurious rather than beneficial. For example, one brand was sold (we will spare the name) for fifteen dollars per ton, while the estimated commercial value was only eighty-six cents. One brand was sold for eight dollars per ton, while the commercial value is given at twenty-nine cents per ton. Another brand was sold at ten dollars, the commercial value is given at thirty-two cents. One sold forty-five dollars, while the commercial value was only six dollars and sixteen cents. Another brand was sold for fifteen dollars, while the commercial value is reported at one dollar and ninety cents. Another high-sounding fertilizer was sold at the high rate of fifteen dollars, while the commercial value was given at the low rate of fifty-five cents.

Is there nothing wrong in all this? Is it not time that at least the attention of the people should be called to some of these facts?

The State Board was created for the promotion of agriculture and the good of the farmer, and not for those who are trying to live upon the sweat of the tiller of the soil without giving him value. Do we want any more evidence to justify this grand jury in finding a true bill, at least against some of these parties?

But we are not done yet. We will next offer the confession of Alexander Gassbag, alias Blowhorn, an agent who has turned State's evidence, in which he has freely confessed, after having been caught in the very act of humbugging the farmers by exhibiting vials like these which I hold in my hand, filled with the "Balm of Gilead," for the healing and fertilizing of sick and sterile soils. One is labeled "Lichen Super-Phosphate," and the other, containing about the same stuff,

having only a more highly-sounding name, warranted pure. But a "rose by any other name will smell as sweet," and so would this "Warranted Pure Ammoniated Superior Phosphate." This is a "jaw-breaker" for farmers. Of course, farmers will know all about the contents of these vials by simply looking and smelling at them. It is presumed that farmers have the sense of sight and smell developed, at least to a reasonable degree; of all but the senses, the most essential to farmers, and the one last discovered, is that of common sense.

The destruction of insects and larvæ of insects at home and at work in the soil by the application of lime will result in more good to crops than some of the worthless commercial fertilizers which are sold at a high price. This sounds strange, but it is nevertheless true, as some brands are without value.

Four hundred and seventy-eight different brands of fertilizers were sold last year in Pennsylvania. It costs many thousands of dollars to make the analyses of all these fertilizers, and to do it again and again according to law, and the farmers must pay this as well as all other expenses for the making and selling of these fertilizers. It is argued that it costs the State nor the farmers nothing to make these analyses, as the law requires the manufacturers of these fertilizers to make a report and pay an annual license to the State, according to the amount of goods they sell, and out of this license money the expenses of these analyses are paid. With the same propriety we could argue that the liquor license and revenue costs the drunkard nothing nor the men who take their grog, who pay from ten to fifteen cents for a single draught of the vile stuff to the dealers in intoxicating drinks, who pay license and revenue to the government for the privilege of their traffic. Were it not for the liquor license and revenue, men could get gloriously drunk for much less money.

We could bring the testimony of many farmers who had their crops injured by some of these high-sounding acid phosphates, and I am willing to be the first witness to be called to the stand. Early in the beginning of this homeopathic land doctrine I was induced to make a test of some of these fertilizers. The following fertilizers were carefully drilled with oats, namely: Pure ground bone (ground on the farm in a little mill kept for that purpose); another composition was made with poultry manure, a little plaster of Paris, and about twice the amount of fine, dry road dust, all well mixed together; third, wood ashes, well mixed with dry sand to make it drill better. So much for home fertilizers. Then two commercial fertilizers were used, one dissolved bone, the other an acid phosphate. These five different fertilizers were carefully drilled with oats, side by side, with nearly the same amount of each in weight, with the following results: Poultry manure and dissolved bone were about equal, and a little the best; ground bone and wood ashes were nearly alike. All of the four named tests proved beneficial; but the acid phosphate, which cost at the rate of twenty-five dollars per ton, proved a failure, not being as good as the ground that had nothing drilled with the seed. It was rather a dry season. This experiment with an acid of phosphate agrees with the experience of many farmers and with the answer received from Dr. Genth, the Chemist of this Board.

The following are answers given to direct questions asked of a chemist: First. Are not some commercial fertilizers which are offered for sale an injury rather than a benefit to plants? To which he replies:

"I do not think that the manufactured commercial fertilizers of any firm are an injury to plants if properly applied and the weather is not unfavorable. Some varieties of acid phosphates containing much acid, if very hot and dry weather would set in immediately after application, would be injurious, but these are exceptional cases."

This scientific answer is corroborated by sad experience. Second question. Are not the selling prices, and the commercial value of fertilizers, as given in the former reports, the best guide for farmers to go by? This question the doctor fails to answer directly, but says "the publication of the tabulated list of commercial fertilizers gives the farmers the best source of information, as to their comparative value." How many farmers of the millions ever see the "reports with the tabulated list?" The majority of these reports go to politicians and professional men, who have very little use for them. What do farmers, or any body else, know of the "comparative value," even if they should happen to see a report, with the "tabulated list of comparative values?" Why not give the selling price with the commercial value, in order that the average farmer has something to go by?

Third question. Are not some commercial fertilizers sold for much more than they are worth to the farmers, or much above their commercial value? To which he gives the following answer: "Some fertilizers sell for more than their commercial value, as estimated by the analysis, but no one is compelled to buy a brand which is sold at a price much beyond its value." "No one is compelled to buy." He says this with an understroke, to show that he was either provoked or in earnest, or both, at my question. How many farmers have access to the chemists' analyses? Not one in a hundred! And if he has access to the analyses given in the book and on the sack, what does the average farmer, or anybody else know, even if he has a smattering knowledge of chemistry, let that knowledge be ever so smattering. The law compelling manufacturers and dealers in commercial fertilizers to give the analyses of their goods has a good effect, as far as it is a check upon wholesale fraud and imposition.

Let us take for example Mapes' potato manure, made in New York and sold in Pennsylvania for fifty-four dollars per ton, as given in the report of 1883. With 6.38 per cent. soluable phosphoric acid, 4.01 per cent. revertible phosphoric acid, 1.43 per cent. insoluable phosphoric acid, 5.93 per cent. potash, 4.23 per cent. ammonia, total amount of valuable ingredients about twenty-two per cent, or in other words, nearly twenty-two pounds out of one hundred are of value. But how much does the average farmer know about these ingredients? and even if he should know, how much of either of these named ingredients does he want? He should know something about this "potato manure" before he sends fifty-two dollars to New York for one ton of something of which only about one-fifth is even claimed to be of any value? This potato manure may be all right, but can a common or even an uncommon farmer afford to risk fifty-two dollars for a ton of stuff of which he knows absolutely nothing?

"Sulphate Ammonia," manufactured in New York and sold for one hundred dollars per ton, "Acme Tobacco Compound," manufactured in Maryland and sold at forty-six dollars per ton, "Cabbage Fertilizer," sold at fifty-two dollars per ton, and the so called "Complete Manure," for light soils, manufactured in New York and sold in Pennsylvania and elsewhere at fifty-four dollars per ton. And so we could go on. What nonsense for farmers to pay enormous prices for par-

ticular fertilizers for the raising of particular crops! Money sent to New York, Boston, Baltimore, Chicago and elsewhere, for a composition of which they know absolutely nothing, with which they expect to raise a particular crop, while they are wasting and treading under foot the same materials and fertilizers with which they are all well acquainted. Fertilizers not only calculated to raise a particular crop, but fertilizers that every good farmer well knows will grow every plant from the hyssop on the wall to the oak in the forest.

I am fully aware of the position I occupy, and expect to be criticised; but the truth will bear criticism, and will stand though the heavens fall. In this connection, let me say that many honest and conscientious parties are engaged in the sale and manufacture of commercial fertilizers, who are doing a fair and honest business, and are making a good article, if farmers could know the good from the bad, and may sell an inferior article at a high price, and believe it to be all right. We will give an example: One of our merchants made a proposition to one of our best farmers upon the faith he had in the goods he handled. He made the following offer: The farmer was to put out a certain field in wheat, on the one-half of which he should use the fertilizer which the merchant was selling, and give him the amount of wheat which that half produced over the other half that had no fertilizer. The result was that the half of the field that had no fertilizer yielded just twelve bushels of wheat more than the other half with the fertilizer. Now, if the farmer had bought the fertilizer, he would have lost his investment, together with the twelve bushels of wheat.

One thing stands in favor of commercial fertilizers. They were instrumental in more generally introducing the grain drill, by which nearly every grain is put to its proper place, and in a furrow that will serve as a protection and support, where a fine fertilizer can give to the crop a good start and all the virtue that is in it. Here is the point where many farmers are deceived, and give undue credit to fertilizers —namely, by the immediate effect of all the virtue contained in the fertilizer, with the additional advantage of the work of the drill, never taking into account the lasting effect and the money it costs. The drilling of a good fertilizer, with the seed to give the plant a start, we heartily indorse; but you want something which you know, and something that costs less money than the prices generally asked for a commercial fertilizer.

There are some commercial fertilizers worth buying, not for general use, but in an emergency, where you can do no better, if farmers could know the good from the bad. The best are generally too high in the price, and the worst are dear as a gift. Many fine stimulating fertilizers can be manufactured on the farm and in the neighborhood where they are to be used from materials which too often go to waste, which could be utilized and applied for much less expense than the price generally paid for commercial fertilizers, fertilizers that would always be sure and safe and have the effect of some of the best commercial fertilizers. Let it be remembered that farmers as a rule make more by what they save than by what they make. There could be no objection to a home manufactory, where materials of the neighborhood could be utilized, and where the farmers could acquaint themselves with the character of the party manufacturing and the character of the goods they buy.

Bone is an excellent fertilizer, if you could know the pure article

from what you can see of it in the inside of the sack, for very few farmers ever pretend to know anything they can learn from the hieroglyphics on the outside of the sack. Farmers should utilize every bone on their premises, and even buy, if they can get a pure article at a fair price; but, in the language of Holy Writ, "Beware of false prophets; beware of the leaven of the pharisees; beware of covetousness." And let us add, beware of acid phosphates and the homeopathic land quacks, who go about the country "seeking whom they may devour," with well-committed speeches, pictures and advertisements, exhibiting vials filled with the "balm of Gilead," for the healing of sick and consumptive soils, who talk like philosophers upon a subject they know practically very little about.

Let me ask in all sincerity, is there nothing wrong in this great scramble for the gain that is derived from the traffic of commercial fertilizers?

Is there nothing wrong where farmers are induced to pay high prices for fertilizers that have very little, if any, value, and after waiting patiently for a season to find their hopes blasted and their money gone? So much for commercial fertilizers. We will now see what can be said for home fertilizers.

All fertile soils are composed of five principal elements—namely, calcareous matter or lime, aluminous matter or clay, silicious matter or sand, dead vegetable matter or humus, and water. All these in proper proportion are absolutely necessary for all and every good crop, and not a blade of grass, nor a single grain can grow without lime, and where nature has not furnished a sufficient supply it must be supplied by artificial means.

Skinner, in his Elements of Agriculture, when speaking upon the subject of lime, says: "If farmers have not often recourse to this means of increasing the value of their lands, it is because they are generally ignorant of the good effect it produces, or because they do not know in what circumstance liming can be advantageously effected." The same author says: "The beneficial effect of lime is sometimes not seen until the second or third year." It often shows a very good effect the first year. This depends upon certain conditions and circumstances. We say the farmer who expects the same result the first season from lime that he does of some active go-off-at-once-or-never fertilizer, which must do all it ever can do the first season, knows very little of the nature of lime.

Nearly all acid phosphates must do their work the first year or never. If it happens to be a dry season, it will not only refuse to do its work, but may prove an injury, as stated by Dr. Gauth and confirmed by the experience of thousands of farmers. Yet farmers are asked to risk their money for a high-priced, dangerously corrosive, unknown, doubtful stuff, while they stumble over materials which are well known to be sure and safe—materials that could be utilized for a trifle, materials that only serve to pollute the God-given elements of air and water, to the detriment of health and comfort.

There are three different forms of lime, namely, carbonate, sulphate and phosphate of lime, and upon these three different forms of lime "hang all the law and profits" of successful farming. And by the application of common, or carbonate of lime to the soil, all three forms of lime will be added, and every fertilizing element contained in the best commercial fertilizer, in a greater or less degree, according to the quality of the lime used and the condition of the soil. This posi-

tion was stoutly denied at our last annual meeting by a gentleman traveling in the interest of commercial fertilizers; especially was it denied that phosphate of lime could be produced by the application of common, or carbonate of lime. The correctness of my theory will be proven by facts, figures and good authority. Standing as I do, in the midst of an intelligent audience, at the fountain of agricultural knowledge, and surrounded by these able professors, I ask you to correct me if I make a mistake, stand by me only as far as I stand by the truth.

We have taken the broad position—let us repeat it—that by liming all the different forms of lime are made, in some degree, as well as all the principal elements found in a complete commercial fertilizer, namely, phosphoric acid, potash and ammonia. Some of these will have to be made by lime in a round-about-way, but it will get there.

Soils, especially clayey soils, contain more or less sulphuric acid, or oil of vitrol, in a mild form. And any chemist, and he need not be a chemist to know, that carbonate of lime brought in contact with sulphuric acid will produce sulphate of lime, which is gypsum, sometimes called plaster of Paris, or land plaster, after it is pulverized, which has the power of attracting and fixing ammonia, the very heart of all fertilizers, and composed of hidrogen and nitrogen. Here we have already two forms of lime, namely, carbonate and sulphate of lime, together with ammonia, which contains the little nitrogen sometimes printed on the outside of the phosphate sack.

Being only a plain, practical farmer, amounting to not very much, especially in a scientific discussion, I brought with me Prof. Johnson's work on Elements of Agricultucal Chemistry and Geology, by which will be proven every assertion I have made, or do now make, upon this subject.

Professor Johnson, speaking upon the importance of lime as a fertilizer, and phosphoric acid, says: "It happens that limestone invariably contains phosphoric acid, and a proportion of it usually increases with that of the visible remains of animals, shells, corals, &c., which occur in it. In the magnesian limestones of the county of Dorham I have found the proportion of phosphate of lime to be as small as 0.15 per cent., while limestones from Lenarkshire, analyzed in my laboratory, amounted to 1¼ per cent., or one hundred pounds of the burned lime contained as much as 2½ pounds of phosphate of lime."

In addition to the evidence given as to the formation of sulphate of lime (gypsum) by applying lime to soils containing acids, Professor Johnson goes further. When speaking on the subject of lime in connection with sulphur and sulphuric acid, he says: "This acid exists in combination with lime in the state of gypsum." This confirms the opinion, that by the burning of lime with bituminous coal, or any other fuel containing sulphur, that sulphate of lime or gypsum is formed.

Lime has a very beneficial effect upon sandy soils by its chemical and physical action, principally by forming silicate of lime (another form of lime made by liming), thus making available plant food out of bound-up and inactive material by its chemical action, and, physically, by making sandy soils more cohesive and retentive.

Lime has chemically and physically a powerful effect upon clayey soils. Chemically it is a great neutralizer; clayey soils contain more

or less sulphuric acid, in itself a very corrosive element and a deadly poison, this it converts into wholesome plant food, both directly and indirectly.

Lime is a great meliorater, helping to make heavy soils warmer and lighter, and light soils heavier. Lime which fills the store house of nature is the most generally used, and does perhaps more to lay the foundation of a fertile soil and to maintain it than all other fertilizers put together. So much for lime.

A mere reference to some of the other home fertilizers can be made. Such as barn-yard manure, both solid and liquid; manure from the poultry house, pig-pen and privy; swamp muck or peat, ashes and road wash. Last but not least are green crops, natures own fertilizers, and lime with its many beneficial effects will always bring clover and a better sod, than by turning down the old carpet that is trodden by the tiller of the soil, and given in exchange for something better. With the above mentioned home fertilizers properly husbanded and applied is the surest, nearest and cheapest road from a sterile to a fertile soil.

There are continually great hills of manure, reeking with fermentation, sending out like so many young volcanoes, the valuable gases on out spread wings, to the ends of the earth, to pollute the air. While rivers of the liquid, the soluble part and the very life blood of the dung hill, are running down the highway of nature, to sow the seed of death and destruction.

This carelessness and waste is in a great measure encouraged by some of these modern land quacks, who by their theory to educate farmers to the belief that it does not pay to handle and utilize these things, when a vest pocket full of some low-grade and high-priced, climax, ammoniated, acid superphosphate, well shaken together, will do the work. It will be only a question of time when the wisdom of these modern philosophers will become necessary to decide the pressing question, as to whether it would pay best to move the barn or the dung-pile

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COMPLETE FERTILIZERS.

By JOHN I. CARTER, Esq., *Chatham, Chester county, Pa.*

The name complete fertilizer for a manurial compound has such a winning sound to it, and affords such golden opportunity to the glib-tongued phosphate agent to dazzle the eyes and deplete the pockets of the unwary farmer, that I feel called upon to put the said farmer on his guard a little, and call his attention to a few facts before he goes too deeply into fancy fertilizers.

It is true that plants require, for full fertilization, three prominent manurial elements, viz: Phosphoric acid, potash and nitrogen. To secure a healthy and vigorous growth, a crop must be abundantly supplied with these elements from some source. The question is from whence? Must we buy them, or are some of them already in the soil? or will they come without their costly purchase? In soils remarkably fertile, like our Chester and Lancaster county soils, experiments and experience have pretty fully shown that one of these manurial elements has been more seriously exhausted than the others. The heavy

grazing and wheat raising for a long series of years have depleted the phosphoric acid to a dangerous extent, and all testimony shows that its return to the soil again from some source is a matter of prime necessity. The manner in which most of our crops respond to an application of dissoluble bone or rock show this; and I need not multiply words to prove the great benefit farmers have derived from the judicious use of phosphate of lime.

But is this true of potash? Have we any experiments showing good results from the application of pure potash? If so, I fail to remember them.

It will not do to cite the use of ashes! It may, and generally does, contain several things good for plants, other than potash.

The burning of brush heaps is often cited as evidence that ashes is a splendid fertilizer for crops. But were the rich spots the result of the presence of potash from the ashes, or from the heating or burning of the soil? The feldspar rock of this section probably yields potash enough for all practical purposes, without any unnecessary outlay to procure it from other sources.

How is it with nitrogen? This you know is the big card with the complete fertilizer men. With much plausibility they attempt to show it as the most valuable part in prepared plant-food. But does experiment or experience show this to be true? Of course, nitrogen in some form is an important component part in plant organization, and an ample supply must be furnished healthy plants.

Part of this must be present in the soil, but probably not that it may enter directly into the plant, but on account of its action on the other soil elements, rendering them available to the plants. Some late experiments of Professor Atwater, show that more than one-half the nitrogen contained in the grown plant must have come from the air. His experiments with plants grown in pure sand and treated with definite amounts of nitrogen, show that a portion of nitrogen must be present in the sand to give the plant start enough to enable it to gather its main supply from outward sources. He also proved that in field experiments heavy applications of nitrogens were unprofitable, not at all in proportion to their cost. This agrees with very many field experiments made by myself on the experimental farm. We used nitroen from several different sources, and in varying quantities; the results were not at all satisfactory. Some plots treated with nitrogen actually grew poorer during the five year course than where no fertilizer at all was used.

The presence of nitrogen in a ground bone is of value indirectly. It assists in the speedy disintegration of the bone; and this is the reason why a raw bone is better than a charred bone, from which all nitrogenous matter has previously been expelled. Nitrogen is a popular ingredient with manufacturers and dealers in commercial fertilizers, because it makes an uncertainty about its value that enables them to increase their profits, without ready detection, and as before stated, gives opportunity for plausible theorizing on the advantages of special fertilizers for special crops.

A few years ago the idea of compounding a fertilizer in accordance with the component parts of the crop to be grown was adopted by some manufacturers, and much talked of, but practically it proved to be of little value. Science was not accurate enough for such close work. Lawes and Gilbert compounded special fertilizers for wheat and turnips, just in the right proportion to make the grain and straw

of the one and the root and top of the other. On application the fertilizers seemed to do well, but to the great surprise of the experimenters, when they tried the wheat fertilizer on the turnips and the turnip fertilizer on the wheat, they responded much better than when treated with their own special fertilizer.

It is possible that the sandy soil of Maryland and Delaware or the completely worn-out Southern soils, may require something like a complete manure; but with soils like ours, with latent stores unreached and unexhausted; with the evidence of years of experience that phosphoric acid is the ingredient needed, it is folly to waste hard-earned money in useless outlays on plausible but deceptive theories. Brother farmer, stick to a well-dissolved South Carolina rock till we see further evidence that something else is needed. It has been a godsend to the farmers of my section. I do not want to see them turn their backs on it too hastily. It furnishes phosphoric acid cheaper than from any other source; much more so than bone, and I am surprised that so many farmers imagine they must mix a portion of bone with their dissolved rock to give it *permanancy*, as they claim. It is permanent because it is unappropriated by the crop. But phosphoric acid is not volatile. If not used it is still there. If you want to put on more than is needed for the wheat, all right; but buy it in the cheapest form. I think it is better, as far as possible at least, to apply your fertilizer for every crop. You then have no unnecessary outlay of money. Any other plan savors of eating two breakfasts at one meal hoping thereby to do very well without your dinner. In speaking so strongly as I have in favor of acidulated rock as our main purchasable fertilizer, I do not mean to encourage the neglect of the farm supply of manures. Indeed, I think the more rock you use the more yard manure you should make and apply. To get the most good out of either, they should go together. The yard manure will furnish all the potash and nitrogen you need without buying any more, and its mechanical action will keep your soils in good condition for yielding heavy crops.

THE USE OF COMMERCIAL FERTILIZERS.

At the annual meeting of the Board, after the address of Hon. J. W. Hickman on the use of commercial fertilizers, the following questions and answers followed:

J. P. BARNES of Lehigh. What kind of fertilizer do you use upon the land alluded to?

Mr. HICKMAN. I am not willing to advertise any particular fertilizer, and hence would prefer not to answer. While I have my individual opinions as to which is the best fertilizer in the market, I do not think that this would be the proper place to advertise it. Suffice it to say that it was a "complete fertilizer"—that is, one containing phosphoric acid, potash and nitrogen.

JOHN McDOWELL of Washington. Was the amount of rainfall taken into consideration? We all know that the amount of rain has much to do with the action of a commercial fertilizer.

Mr. HICKMAN. I will reply to the gentleman by asking a question.

When he applies a heavy coat of barn-yard manure for potatoes or corn, does not the amount of rainfall have very much to do with its action? Is not the crop damaged and lessened by dry weather? Is not the yield much less during a dry season than during a wet one? This objection holds good everywhere, and may as readily be raised against barn-yard manure as against commercial fertilizers. The difficulty often lies here—a wet season with heavy rains, hard freezes, and ice on the surface injures the crop and decreases the yield. This is attributed to the commercial fertilizer, when the same or worse would have happened with barn-yard manure. Too often the fertilizer receives the blame of every accident or setback, and we are told that their application will not pay, and that you cannot get your money out of fertilizers.

To a gentleman with whom I am familiar, as also are others here, I said "I want you to put five hundred pounds of fertilizer on an acre of your field, I to furnish the fertilizer, and put your barn-yard manure in an ordinary coat alongside. I want you to plow the manure down in the usual way. I will not charge you anything for the fertilizer, but will take my chances in the extra crop which it produces." The season was very dry, and the weather was very bad for corn, which was very late in earing. I saw him again in March, and asked him for the result. He said, "I am ashamed to tell it, and I did not intend to bother you." I said, "Tell the truth about it, for the facts should stand." He said, "I measured carefully, and there was two bushels more corn on the acre which had no fertilizer than there was where the fertilizer had been applied." I then said, "Did you observe that the acre upon which no fertilizer was put also beat that to which you gave a good coat of barn-yard manure?" He admitted this fact, but stated that it had not occurred to him before that this fact influenced the experiment or its result in the least. The argument which was good against the commercial fertilizer was equally good against the barn-yard mnnure; in fact, in a dry season the land to which yard manure is applied will usually be the worst.

Under a foreclosure, a gentleman well known to some who are here to-night, bought the land. He was on the wheat field (the same plot to which the fertilizer and manure had been applied the preceding year to corn), and said, "What is the matter with this portion? It has double the crop per acre that is on the balance of the field. Why is it?" It was explained to him that it was the effect of the fertilizer, which the owner obtained free of cost, because it did no good to his crop. From any elevated position this plot of fertilized ground could be readily picked out from the rest of the field.

The difference between a good and a poor crop is often widened by the fact that in the latter case the ground is left bare and unprotected from the sun. Where there are plenty of grass roots and plenty of grass (or other crop) covering the ground it does not suffer nearly so much from the direct rays of the sun. When we sow clover, we manure it and enrich the ground, so that we may get a crop. During a wet season there is plenty of water to render the available food in the soil soluble and enable the crop to obtain the benefit of it; if the season is dry, that is not the case; but if we have the fertilizer in its most soluble form, we then enable the crop to get it that much easier. When the temperature of the air is up to ninety degrees, every cubic foot carries a large amount of moisture. Put a pitcher of ice-water out in this air and the outside becomes moist. This moisture comes from

the air outside of the pitcher, by cooling the air parts with its moisture, which is deposited upon the outside of the pitcher. Air at ninety degrees, when reduced to seventy-five degrees, will in this way give up about one-half of its moisture. Black your boots during the driest day of the season, and walk through a heavy growth of clover, the gloss will be taken off, because the air under the clover, being cooler than that above, parts with its moisture, which is deposited upon your boots.

Mr. J. A. HERR of Clinton. What are the comparative values of available phosphoric acid from South Carolina rock and that from bone?

Mr. HICKMAN. There is no difference in actual value, a pound of available phosphoric acid having the same value no matter what its source may be. This, however, is not the case with the insoluble form.

J. A. HERR. What will probably be the effect of the continued application of a fertilizer which only contains phosphoric acid?

Mr. HICKMAN. The effect of a continued application of phosphoric acid, or of any one element, must necessarily be to sooner or later exhaust the other two. The store of potash in the soil may be so large that it cannot be exhausted for a long time; but the time must come when it will be exhausted. You may go on applying South Carolina rock indefinitely, if by feeding heavily, and applying the resulting manure to the farm, you keep up the supply of the other two elements in this way; but it will not do long to continue the use of any single element where no yard manure is applied. It is much more economical to keep up the supply of any element than it is to permit it to become exhausted, and then endeavor to replace it again. South Carolina rock may be used in connection with stable manure, because the latter is poor in phosphoric acid and rich in potash and ammonia. The two together make a complete manure, as we understand the term. Instead of buying the nitrogen and potash in the shape of a fertilizer, they have bought it as food, and have fed it to the stock and saved the manure.

A MEMBER. Would they in this way obtain enough potash to balance the exhaustion of the potash, or would the soil in time become exhausted of potash?

Mr. HICKMAN. That would, in great measure, depend upon the kind of food fed and the amount of potash in the soil. No two kinds of manure, nor two soils, will agree in the amount of potash which they contain.

J. A. HERR. What is the manurial value of a ton of wheat bran?

Mr. HICKMAN. Our table makes the manurial value of wheat bran about twelve dollars and five cents per ton, but the valuation is based upon the prices of fertilizer supplies which prevailed several years ago, and is consequently too high.

Note by the Secretary. Taking the table presented at one of our former meetings as a basis, giving forty-four and eight-tenths pounds of nitrogen, fifty-four and six-tenths of phosphoric acid, and twenty-eight and six-tenths of potash per ton of wheat bran, and applying to them the figures of valuation now used by the Board, the manurial value of a ton of wheat bran before feeding would be nine dollars and seventy-eight cents.

JOHN I. CARTER of Chester. Could you not answer Mr. Herr's question somewhat in this way: Suppose the soil contains all of the nitro-

gen and potash that is needed, but is deficient in phosphoric acid, might you not go with continued applications of phosphoric acid without any danger of exhaustion?

Mr. HICKMAN. There is no doubt of the truth of the question, because, as I have stated, you continually keep up the supply of the ingredients which you do not apply by the addition of barn-yard manure. The question which we are now considering is, "Can exhausted land be kept up or increased in fertility by the use of commercial fertilizers alone?" This admits of no application of manure, and of course it necessarily follows that the elements not applied must sooner or later become exhausted.

R. S. SEARLE of Susquehanna. Do not some of our scientific authorities assign wheat bran a higher value than you have given?

Mr. HICKMAN. It is possible that they do, but in nearly all of such cases you will note that the valuations were made at a time when the ingredients of a fertilizer were much higher in price than now. In my opinion, twelve dollars and five cents is quite as much as it will bear, and more than the crop will get from it.

R. S. SEARLE. What is the value of a ton after being fed?

Mr. HICKMAN. That will, in great measure, depend upon the class of animals it is fed and upon what use is made of the product. Some cows have a much stronger digestive apparatus than others, and if they, by digestion, take more out of the bran they must leave less in the manure. Estimate a cow to give ten quarts of milk per day. One thousand quarts of this milk will take out of the feed ten pounds of nitrogen, four of potash and twenty of phosphoric acid. Upon the former basis of valuation, these elements are worth three dollars and sixty-eight cents; taking this from the total manurial value we have eight dollars and thirty-seven cents; making the usual allowance for waste of manure, we have the value of one ton of bran (as manure) after feeding, as six dollars and seventy cents. That is, it is worth as a fertilizer twelve dollars and five cents before feeding and six dollars and sixty cents after it is fed.

Secretary EDGE. I note that the fourth question which you have on your list is, "The effect of the present State fertilizer law; what have you to say as to its effect?

Mr. HICKMAN. As to the application of the fertilizer law, there are a great many people who become confounded on this matter of commercial value. They think they can buy safely on them. They do not settle the agricultural value, unless a man knows exactly what he wants and the condition of the soil upon which he applies it. It is in this way: In a general way it protects the farmer. It requires the man who manufactures it to stamp it on the bag and put it on the market for what it is. If phosphoric acid, or nitrogen, or potash, the label must be just that. If a man has such knowledge as to know what the land requires—and that is what we give this address for; first, to determine what he does want—but in the absence of knowledge of what he wants precisely, he had better take a little of something that he does not want—he had better buy a little more of what he does not want than to buy a little less. As he is getting thirty-three per cent. in the whole mass he is going to buy, why quibble about buying a little nitrogen? In that way he would be protected.

We are in a kind of transitory state as farmers, and moving from the old things to the new. There are no people so hard to teach—and I am among that class too; I am not exempt from the infirmity, for

infirmity it is—there are no people so hard to teach as old farmers. They cling to traditions and old notions so tenaciously you cannot get them away from them. It is a double work, because it is hard to get out of their minds the old and replace them with the new things, as they call them.

Mr. EDWARDS. By putting on four hundred pounds per acre is there any danger of lodging the crop? I am an old farmer, and know that heavy applications of barn-yard manure will throw the crop down even before it is headed. Will an overdose of fertilizer do this?

Mr. HICKMAN. I have yet to find a soil upon which any reasonable application will lodge the crop. By the application of large amounts of nitrogen in yard manure, without any corresponding amount of phospheric acid, you weakened the straw and lodged the crop; the phosphoric acid is largely concentrated in the grain and but little in the stalk or straw.

DAVID WILSON of Juniata. Is not the grain, other things being equal, more likely to lodge on heavy clay or limestone soils than on lighter or sandy soils?

Mr. HICKMAN. Yes, sir; the silica in the sandy soil serves to stiffen the straw and make it stand up; in limestone soils this is deficient, and hence the result as stated.

M. W. OLIVER of Crawford. Can a farmer afford to plow under a good crop of clover as manure?

Mr. HICKMAN. Our tables show that if fed to stock it has an actual value of fifteen dollars and ninety cents. If it has this value and produces at the rate of two tons per acre, it certainly will not pay to plow it down, for its value (as food) in money will, in the form of a commercial fertilizer, buy much more plant food. It will hardly pay to turn two tons of clover hay (or its equivalent) under anywhere in Pennsylvania; it will be better to feed it, save the manure and buy fertilizers.

Secretary EDGE. In valuing the manure resulting from feeding one ton of clover hay would you not make a material difference as to what kind of stock it was fed? That is, would it not be (the manure) worth more from some kinds of stock than from others?

Mr. HICKMAN. Certainly; if the animals to which it is fed retain in their systems (as fat) or in their product (as butter or milk) a large amount of the value of the clover hay the manure will be less valuable.

J. A. HERR. In computing the value of a ton of clover hay, did you take the stalks and roots left on the ground into calculation?

Mr. HICKMAN. No, sir; we only take what is hauled to the barn and not what is left on the field. It is estimated that the roots and stalks left on the field weigh as much as the portion hauled to the barn; the roots, however, are not so high in manurial value as the hay. If you have profitable stock it will certainly be more profitable to feed the hay, and you cannot afford to plow it down.

Prof. DAVID WILSON. The manurial value of some commercial fertilizers is placed at forty dollars per ton; in estimating the value of a ton of clover hay, did you take into account the value of the vegetable matter or carbon which it contains? No, sir; this vegetable matter is of no commercial value, and is only valuable as an absorbent; the plant can more readily get all the carbon it needs from the atmosphere. Careful experiments demonstrate that this humus is of no value and my be left out without detriment to the plant.

R. S. SEARLE. Do you vary your complete fertilizers with the crop to which they are applied? In other words, do you put more potash in your fertilizer for corn-fodder than for wheat, or do you use the same fertilizer for all?

Mr. HICKMAN. We are in a transitory state, passing from the old to the new, and changing our methods and theories; thus far the only safe thing which we can do is to find out what our soil lacks and what the crop wants and then supply it; we had better have too much of it than too little; when a farmer knows exactly what he ought to know, or what he is privileged to know, and which I hope in time he will know, he may be able to apply exactly what the crop needs (not more or less), but at present we must be content with getting enough, even at the risk of wasting some. It is a very safe rule to apply at least fifty per cent. more than the crops need.

Hon A. L. TAGGART of Montgomery. Is it profitable to use four hundred pounds of fertilizer per acre? If four hundred pounds is better than two hundred, as you have said, is eight hundred better than four hundred, proportionately.

Mr. HICKMAN. The term "four hundred pounds of phosphate" is very indefinite; there are four hundred and sixty-four kinds now sold in the State; they vary in actual value from three dollars and fifty cents to forty dollars per ton. If you take a fertilizer containing twelve per cent. of phosphoric acid, one per cent. of potash, and the same of nitrogen, and apply eight hundred pounds per acre, you put on more than your crop can utilize, and in this sense waste it; but it is not wasted, but is stored up in the soil for future crops. I have known fifteen hundred pounds per acre used with profit; it is not so much the amount that you spend as the amount that you can get back. I think that a fault with many of our commercial fertilizers, is that they contain too much phosphoric acid in proportion to their nitrogen; the latter ingredient should in most cases be increased; the phosphoric acid is often (especially in large applications) in excess.

Hon. A. L. TAGGART. Why is it that Peruvian guano produces a better crop of wheat than barn-yard manure?

Mr. HICKMAN. It does not always do so by any means; that may have been the gentleman's experience, but is not that of all. Peruvian guano has the same fault as South Carolina rock—it contains an excessive proportion of one element (nitrogen), and is deficient in the other two, phosphoric acid and potash; it is not well balanced.

Mr. EDWARDS. Would it not produce a stiff straw that would not lodge?

Mr. HICKMAN. No, sir; in large amounts it would have the same effect as a large application of stable manure, and would throw the crop down before filling.

Mr. EDWARDS. Do you know of a fertilizer in the market which has the proper proportion of phosphoric acid? If a fertilizer has twelve per cent. of phosphoric acid, is there one running to nine or even seven of potash?

Mr. HICKMAN. No, sir; except special manures for potatoes, which often run as high as five or six of potash. You note in the charts the amount of potash in corn-fodder, oats and wheat straw and hay; these the farmer usually feeds on the farm, and thus keeps the potash at home; but on the other hand the phosphoric acid and nitrogen enter largely into the grain and are very often sold off the farm. There is an accumulation of potash. In such cases, with a fertilizer having

a large percentage of phosphoric acid and a low one of potash, you will get as good or better results; the manure will thus vary with the plan of farming.

A MEMBER. Suppose that you have a commercial fertilizer which contains fifteen per cent. of phosphoric acid, a large amount perhaps, and three of nitrogen, with two of potash, that would make twenty per cent.; there are still eighty per cent remaining. On this I would base the following questions: Of what does this eighty per cent. consist? And would it not be better to buy the elements on which you do place a manurial value and exclude the others?

Mr. HICKMAN. In theory the gentleman is right, but in practice he is wrong. Take for example pure bone; it will contain about four hundred and thirteen pounds of these valuable ingredients to the ton, and yet it is not adulterated; you have one thousand five hundred and eighty-seven pounds of worthless matter to the ton, but you cannot get shut of it; the process which would take it out would be too expensive to permit of its application. You do not get anything pure; not even mankind.

Hon. C. C. MUSSELMAN of Somerset. I, for one, have very little faith in this homœopathic or pepper-box quackery for the cure of sick or worn-out soils. While there are a few commercial fertilizers worth buying, there are hundreds, yes, about two-thirds of all the brands of the store goods now sold that have not the commercial value or chemicals in them that it sells for. One brand is sold for fifteen dollars, while the commercial value is only eighty-six cents; another is sold for ten dollars, while the chemicals in it are worth only thirty-two cents; another is sold for forty five dollars, while the commercial value is only six dollars and sixteen cents. But worse than this, many brands are imposed upon the farmers that have no value at all; and still worse, some are palmed off on the innocent farmers that are not only worthless, but an actual injury to crops. Is this not imposition? Yes, worse. It is robbery. It is true that the State Board of Agriculture had a law passed compelling the manufacturer to give the analysis on the sack, but how many farmers know what it means if they see the analysis on the goods. They generally listen to, and take the instructions of some agent that generally talks about a thing of which he knows very little, practically or theoretically, trying to make farmers believe it does not pay to lime, or haul manure any distance, and keeps talking until the farmers begin to wonder which of the two it would pay best, to move the barn or the dung pile. Nobody will haul dung and lime if we can carry the fertilizer out in our vest pockets. Their theory teaches waste and bad ecomony. Lime and manure, the great natural fertilizers, are to remain dead stock in the storehouse of the earth, in order to give these public benefactors a chance to entrench themselves behind their sand bags! For which we are asked to send our money to New Yoık and Chicago, and other places a thousand miles away.

My remarks are aimed at the great bulk of this worthless stuff, and not at the few honest brands that are manufactured and sold. A good fine concentrated fertilizer, whether made at home or aboard, and drilled in with the grain, will generally give a start, and show a good and immediate effect, as it generally goes all right into the plant. But we must look to something else to lay the foundation of a fertile soil. Stable manure will do it as far as it goes, but it is upon *lime* that we must count as the fertilizer, all other fertilizers are mere helps. It is

emphatically so in our part of the State, confirmed by practice and theory. Where nature has furnished a sufficient supply of lime, it need not be done artificially. Lime is one of the five grand divisions of a fertile soil, and without it not a spear of grass can grow. The little bulk of commercial fertilizer acts only chemically, while lime acts chemically, physically, directly and indirectly. It will do all and more than the best commercial fertilizer. I venture to assert that lime will give all the different elements, such as nitrogen, potash, ammonia and other elements derived from the best commercial fertilizers, then in addition lime acts physically as an ameliorator, and chemically as a neutalizer. I can buy twenty tons of lime for the price you pay for one ton of commercial fertilizer. Lime converts sulphuric acid in the soil into sulphate of lime which is land plaster, which has the power to attract and fix ammonia, the very heart of manure, there you get your nitrogen, and by the burning of shells and fossils contained in limestone you get phosphoric acid. I know that some will deny this last assertion, but so says Prof. Johnson, in his work on agricultural chemistry. I know too that I am treading on the toes of hundreds of manufacturers and thousands of agents of this high sounding and sweet smelling store goods; but as a member of the State Board of Agriculture, it becomes my duty to expose all frauds and impositions practiced upon the farmers, of which I am one. And I can assure you that pictures sent around to look at, and the bottles that are sent about with their contents for farmers to smell at, are becoming a stench in the nostrils of intelligent farmers. And I know, too, that the one who opposes this pepper box and picture farming is called old fogy and behind the age. What I say of commercial fertilizers I shall not apply to good, pure bone, of which I am an advocate. But I repeat that in our part of the county nothing is so cheap and effectual as a judicious application of lime to fertilize the soil.

J. A. GUNDY of Union. I would make this reply to what Mr. Musselman has urged because I have had practical experience in the matter: I divided a tract into twentieths of an acre. I am a surveyor, and the work was carefully done with a compass and chain. On two of these plots I put nothing in the way of a fertilizer; on one I put eighty-five per cent. of potash, ten pounds; on another fifteen pounds of bone black; on another twenty pounds of dried blood; on another two of these elements; on another two others; and to another all three were applied; on one I put half a load of barn-yard manure, and on one one and one-half bushels of plaster, and on another one and one-half bushels of lime. We weighed both corn and fodder carefully; I have not the exact results with me, but I remember that the lime appeared to have damaged the crop, or at least it lessened the yield; it cost me six cents per bushel. The plaster did little or no good, and the complete fertilizer (containing all three elements) did by far the best. The barn-yard manure was fourth on the list of yields; these were actual experiments in the field.

Hon. C. C. MUSSELMAN. My doctrine is that lime is indirectly a fertilizer, insomuch as it utilizes plant food which otherwise might be lost.

Mr. HICKMAN. One year ago last winter I had the pleasure of addressing an assemblage of farmers at Uniontown, in Fayette county, and there we had up the efficiency and action of lime. Many of them took precisely the same ground as has my friend from Somerset

[Judge Musselman]. One of them asked me if I would put fertilizer upon part of his field in competition with lime, and whether I would stake the value of the fertilizer upon the result. I told him that I would do so, and we entered into an agreement. It was upon a farm where the iron company was taking out limestone and utilizing a part of it, but leaving a considerable amount of finely broken stone not wanted at the furnace, so he had nothing to do but haul the stone to the pile, pile it up, and burn it; the coal was on the land, and the only charge against the lime was for actual labor. He put this lime in competition with our fertilizer on one-half of the twenty acres of land; he understood the value of lime as too many understand it, and he was going to manufacture all the elements of plant food from the soil by the use of lime. He applied seven thousand bushels to his half of the field, or at the rate of seven hundred bushels per acre.

Hon. C. C. MUSSELMAN. That was entirely too much and injured the land.

Mr. HICKMAN. That is the true solution of it. The fertilizer was put on at the rate of six hundred pounds per acre. The fertilizer beat the lime badly, of course.

In Montgomery county I met with a man named Cugler who was applying lime and had great faith in it. The gentleman with whom I was staying said, "I wish that you would go over and talk with Cugler." I did so. He had just reached home with a four-horse load of lime, and, after putting his horses away, came into the house to talk to us. I said, "We came over to tell you our theory of farming and to offer a few suggestions." We sat there and talked of the action and value of lime, and finally I said, "I want you to apply your lime to two or three plots and a good fertilizer to two or three others; give the matter a fair trial and see if you do not become more progressive." I have never seen him since, but I have heard from him. He is now convinced that he then learned something, and from that day to this has never hauled another load of lime.

R. S. SEARLE. We are now discussing the question of how to improve worn out or exhausted land by the use of commercial fertilizers. How would you use them?

Mr. HICKMAN. Suppose, in answer to that question, I give the experience of Thomas Gale of Hainesville, Kent county, Maryland. Mr. Gale had assigned to him about six hundred acres of very poor land; a reasonable corn crop had not been known to grow upon it. I was visiting an agricultural club near by and he sent for me to come and look at his land and tell him what to do with it. Upon the tract there were some buildings, but he was poor. I said, "There is only one thing in the world for you to do, and that is fertilize it, and you must be liberal with your fertilizers." People there only use two hundred pounds per acre, and I said that he must use six hundred pounds per acre. He said, "That is worth more that the land. I understand that in some cases you have furnished the fertilizer, taking your pay out of the increase in the crop. Is your faith strong enough to do that in my case?" I answered, "I will give you six hundred pounds for every acre but one (the field contained thirty-two acres), and you are to put the field in corn; you may take from every acre as much as is produced upon the acre with no fertilizer." He answered, "You are the man that I have been looking for, how about the wheat which follows the corn?" I replied, "We will divide the wheat crop with you and give you four hundred pounds more per acre for

it." I sent him for the corn six hundred pounds per acre, of which four hundred pounds were plowed down and two hundred put in the hill when planted. It was not a favorable year for corn, but people came miles to see it. When he hauled in his corn he measured it. In May he sent the corn to Baltimore and paid six cents per bushel in freight and weighing fees. When I came to settle with him he gave me my money and I found that I had the price of the fertilizer (forty-two dollars per ton), six per cent for the money, and one hundred and forty-one dollars over; of this I returned him one-half. In the succeeding wheat crop there was an excess over the cost of the fertilizer of sixty-five dollars, so that I could have made him a present of two hundred dollars and obtained full price for my fertilizer. The field was sown with timothy and clover in the spring, and next year he mowed it and had more than any other man in that section of the county, and had five or six bushels of clover seed per acre.

After mowing it for awhile, he turned it under for wheat, and applied five hundred pounds of fertilizer, and had thirty-five bushels of wheat per acre. That field is known as "the Hickman field" and will be so known for some time to come. Last year I got from him the returns from one hundred and thirty-five acres, and upon that result I wrote and read a report before the county agricultural society, and I am free to say that it has attracted great attention. He had some doubts about buying a machine for threshing, but I said to him, "Buy the machine and pay for it off the one hundred and thirty-five acres." That one hundred and thirty-five acres is now worth a great deal more than the original tract, and I saw him threshing sixteen hundred bushels of wheat off his poor land. He has a good bank account, and pays his hands promptly. You may write him for the facts as I have given them to you.

J. A. HERR. Does not the mechanical condition of the soil have something to do with the action of the fertilizer?

Mr. HICKMAN. Not so much as the fertilizer has upon the mechanical condition of the soil.

J. A. HERR. Must not every one be, to a certain extent at least, his own experimenter?

Mr. HICKMAN. Certainly; and in the present condition of our knowledge this is the only way in which we can avoid errors.

Secretary EDGE. Is not forty per cent. South Carolina rock more economical than the ordinary grades, which give but fifteen per cent. and is it not a rule that the higher grades of fertilizers are the most economical?

Mr. HICKMAN. By transportation fertilizers have their value increased, and the highers grades, by the decrease in bulk, cost less in freight; hence they are usually most economical.

H. M. ENGLE of Lancaster. Some in our county have been very successful in obtaining good crops by the use of South Carolina rock alone.

Mr. HICKMAN. That indicates that the soil is not deficient in potash, and that the crop obtains sufficient nitrogen from some other source than the manure.

Note by the Secretary. The discussion as here given and much that was not preserved, from the fact that the lecture and discussion was illustrated by diagrams, indicates that at the Bucks County Institute there was a difference of opinion between Mr. Hickman and a

number of the practical farmers there present. It was also evident that this difference of opinion was due to the difference of their estimates of the value of carbonaceous material, such as straw and corn fodder. Mr. Hickman took the position that by the continued application of phosphoric acid, potash and nitrogen in amounts larger than was removed by the crops, the soil would become more fertile and the resulting crops would be increased. On the other hand, Mr. Tomlinson and others assumed that vegetable matter (carbon) was necessary to the crop, and must be added to the soil in some available form. Mr. Loyd claimed that plowing down clover was one of the best and most economical forms in which carbon could be added to the soil. To this Mr. Hickman objected, on the plea that it was too expensive, the clover being worth very much more as hay than as a green crop for plowing under. To illustrate this, Mr. Hickman exhibited the figures, showing the value of one ton of clover fed as hay; also the value of the manure which would result from the feeding of one ton of clover hay. The sum of these two amounts was much larger than that of the manurial value of the ton of hay when in a green state.

In relation to the value of vegetable matter, we think that the views of Mr. Hickman were not fully expressed, and were misunderstood by many of the audience. Mr. Hickman intended to convey the idea that, in his opinion, the roots and stubble of the crops grown on the soil, together with the usual manure made on the farm, would, with the atmosphere, supply all of the carbon (the substance of vegetable matter of all kinds) needed by any and all crops. Going even further, Mr. Hickman advanced the opinion that without the manure of the barn yard the roots of the crops, together with the stubble usually left on the field, would furnish an abundant supply of carbon for all time, and that it was not absolutely necessary to add any more.

The assimilation and use of carbonaceous matter by the plants is one of those problems of agricultural chemistry not yet thoroughly understood, and in the discussion alluded to (at the Bucks County Institute) no allusion was made to the very important item of the *mechanical* of vegetable matter upon the soil. While it is no doubt true, as claimed by Mr. Hickman, that the atmosphere will furnish an ample supply for the growth of the plant, yet it is a question whether an entire removal of actual vegetable matter from the soil would not sooner or later result in a mechanical condition which would be very unfavorable to plant growth and development. It is a well known fact that all new soils, and such as have lately been cleared of their timber, are unusually productive, and it is an accepted theory that as by after cultivation the supply of vegetable matter diminishes, the fertility decreases in about the some ratio. This may not be due to the absence of carbon as food for the plant, and we think that it is not; but it is more probably due to to an improper condition of the soil as to looseness and porosity. A fertile soil which is too compact will not produce a satisfactory crop, and it is but fair to claim that much of this porosity is due to the vegetable matter in the soil. It is questionable whether the mere plowing down of the roots and stubble of the crop would furnish enough carbon for this purpose. At any rate, we have no record of any long continued experiments in this direction.

Considered in all of its bearings, the question of the actual effect of carbonaceous matter in the soil is a very interesting problem, and one upon which, as before stated, authorities do not always agree. Thus,

for instance, Dr. J. B. Lawes, the celebrated English experimenter, writes as follows:

"Whenever vegetable matter is placed in an arable soil, such as clover plowed in, dung applied or the pasture broken up, the soil is found to be full of carbonic acid. A great quantity of carbon is burnt off, and by degrees more stable compounds are formed, in which the relations of carbon to nitrogen is very different to what they are in living vegetation. Straw, for instance, contains nearly half its weight of carbon and less than one per cent. of nitrogen, the proportion of carbon to nitrogen being fifty to one, while surface soil contains carbon in proportion of ten to one of nitrogen, and as we go lower down the proportion of carbon to nitrogen grows less. It is these particular compounds that are acted upon by living organisms giving rise to nitrification, and part of our recent inquiries have been directed to ascertaining whether the carbon of the subsoil is capable of nitrification. We have no evidence that plants take carbon from the soil. Some of our fields have received no carbon for nearly fifty years, and we can obtain, by means of mineral manures and nitrates, as large crops as we did at first. When first a pasture is broken up there can be no doubt that very large quantities of carbon are converted into carbonic acid, and at the same time other compounds are formed, which are only acted upon very slowly. To exhaust a soil is, perhaps fortunately for mankind, a very slow and difficult process. This may be seen by our unmanured wheat crop, which at the end of nearly half a century still yields over twelve bushels per acre."

Mons. George Ville, the celebrated French experimenter, thus writes in relation to the assimilation of carbon by plants: "The quantity of carbon that enters into the composition of plants is, in round numbers, from forty to forty-five per cent.; it therefore plays an important part in vegetation. When I state, however, that to the agriculturist it is absolutely unimportant, and may be excluded from manures without the fertility of the soil being affected, I shall appear to be contradicting myself. To prove, however, that the contradiction is only apparent, I need only remark that the carbon of plants has its origin in the carbonis dioxide of the air and that the atmosphere furnishes an inexhaustably supply.

"To complete the study of the assimilation of carbon, it is only necessary to say that if the atmosphere is the principal source from which the plants derive their supply of this element, they nevertheless draw a certain quantity from the deeper layers of the soil, the carbonis acid contained in which is absorbed by the roots and afterwards decomposed by the leaves into oxygen and carbon, the latter element being assimilated."

As is usual in such cases of difference of opinion, it is probable that the safe course will be found in a medium between the two, and that the better plan for the Bucks county farmer will be to carefully save and apply all the barn-yard manure which he can make and accumulate and at the same time buy and use all of the commercial fertilizers which he finds will pay him; in this way he cannot fail to increase the fertility of his farm and increase the average of his crops. He will accept added fertility from any source not too expensive, and after obtaining it will endeavor to retain it in his soil and on his farm.

Even if it is proven that his plants can obtain all their needed carbon from the atmosphere, he will still, we think, find himself amply repaid for the trouble and expense of the application of his yard ma-

nure in its actual manurial effect, so far as its nitrogen, potash and phosphoric acid are concerned, and in the mechanical effect which it must necessarily have upon his soil.

For the purpose of obtaining the views of practical farmers upon the use of commercial fertilizers, a number of letters were addressed to such as were known to be practically acquainted with the subject asking their views upon such phases of the question as had attracted their attention. We give the following extracts of their replies:

JOHN I. CARTER, Chatham, Chester county, Pa. "The general use of commercial fertilizers in our section of the State, *i. e.*, southern part of Eastern Pennsylvania, certainly increased the yield of crops in a very marked manner. The wheat crop was increased ten to fifteen bushels per acre; corn twenty to twenty-five, and much better yields of hay and straw. This enabled the farmers to make more manure, and in this way made a general improvement in the fertility of the soils. Our farmers have been using these fertilizers for the last ten or fifteen years with no apparent diminution in their good effects; but how long this may last we do not know. We began by using compound fertilizers; that is those containing more or less ammonia, potash and phosphoric acid, but without much regard to the proper proportion of these food elements to the wants of the special crops to which they were to be applied. It was soon noticed that those containing soluble phosphoric acid in the largest proportion, or at the cheapest rates, were the most desirable and gradually brought about the general use of a well acidulated South Carolina rock. There were two reasons for this. One was that the rock presented less opportunity for adulteration; and, secondly, it was the cheapest form in which soluble phosphoric acid could be bought. Theoretically it would be judicious to use a fertilizer compounded with special reference to the needs of the crops to be grown; that is, containing the relative quantity of nitrogen, potash and phosphoric acid to make up the crop; but practically it was found that our underlying feldspar rock, which rapidly disintegrates, gives us sufficient potash; and the rich barn-yards, which every farmer should have, adds enough of nitrogenous or carbonaceous matter, leaving only the phosphoric acid to be supplied in the purchased fertilizer. This element was really the one most likely to have been exhausted by our system of farming, much more of it being carried off in the dairying and cattle feeding so largely carried on in this section of the State. That these fertilizers are not in the nature of stimulants or temporary in their effects was shown by experiments made at the Eastern Experimental farm, where applications of soluble phosphoric acid applied to the corn crop made a marked increase in the crops throughout the whole course of corn, oats, wheat and grass. The following results came from equal value applications on one-eighth acre plots, fertilizers applied on sod and and plowed down for corn; nothing else applied during the four years' course:

KIND OF FERTILIZERS.	Pounds of fertilizers applied.	Pounds of corn ears in 1874 per one-eighth acre.	Pounds of oats in 1875 per one-eighth acre.	Pounds of wheat in 1876 per one-eighth acre.	Pounds of grass in 1877 per one-eighth acre.
Nitrate of soda,	20½	481	81	65¼	84
No manure,	....	396	74½	60½	120
Sulphate of ammonia,	17⅔	510	80¾	57¾	78
Barn-yard manure,	....	732	109½	116½	292
Ground bone,	50	646	105½	137½	364
Bone superphosphates,	45	723	115¼	181¼	500
Mineral superphosphates,	75	757	118	189	539

The report of these and many similar experiments drew the attention of our farmers to the value of commercial fertilizers, and to the special advantages of those containing largely of phosphoric acid, and so thoroughly convinced were they of their value that our best farmers use them on nearly all their cultivated crops. Their usual practice is, in late winter or early spring, to put a light coat of yard manure on sod for corn, and plow down four hundred pounds of dissolved rock in addition. This, under favorable circumstances, will insure a crop of seventy-five to one hundred bushels of corn, weighed out of the field; for oats, about two hundred pounds is drilled in with the seed, and for wheat another light coat of yard manure, if the barnyard will furnish it, and about three hundred pounds of fertilizer, also drilled in. This gives the wheat a good start in the fall, even if the grain is sowed late. The late seeding carries the crop beyond the first hatch of the Hessian fly, that so often damages the early sown wheat. These annual applications are not made because of the transient effects of the fertilizer, but because the first application seems to stimulate a vigorous early growth, which carries the plant beyond the risks and dangers of this stage. Of course no good farmer should neglect to make and save all the manure his convenience and time will permit.

R. G. F. KSHINKA, Berwick, Pa. My experiments have been too limited to add much to the general stock of knowledge upon this subject. The little on hand, however, is cheerfully contributed.

The soil upon which my experiments have been chiefly made is somewhat difficult to name, and for want of anything better might be called a gravely clay (of a friable nature).

My first experiment of any consequence with commercial fertilizers was upon a twenty-two acre field. This field had been entirely run down and left to shift for itself for several years. It was to some extent covered with small scrubby pines, dewberries, and a "sprinkling" of wild grass, altogether not enough to cover the soil. There were many good-sized patches where the ground was quite bare.

After the pines were pulled up and burnt, the ground was plowed the latter part of June. About the tenth of July the field was thoroughly harrowed, and three pecks of buckwheat, with two hundred pounds of fertilizer, drilled to the acre. Dissolved South Carolina rock was applied to a part, and a high priced and grade complete

phosphate to the rest of the field. The season was dry, and the yield twelve bushels per acre. This was fully up to the average of the neighborhood. No difference was noticeable between where dissolved South Carolina rock or the complete fertilizer had been applied. After the buckwheat was removed, the field was twice cultivated, going over it diagonally, and one bushel and one peck of rye, with two hundred pounds of dissolved South Carolina rock, drilled to the acre the latter part of October. Being short of phosphate, and for fear the ground would freeze before more could be obtained, wood ashes were substituted and drilled on about five acres.

The field yielded over three hundred bushels of a fine grade of rye, the poorest part of the field with phosphate, yielding twelve (12), and the best twenty-five (25) bushels per acre, while the poorest part, with ashes, yielded scarcely the seed, and the best not exceeding eight (8) bushels.

This was a wonderful difference, the additional straw in the former alone fully paying for the phosphate.

This marked difference continued in the growth of the grass; in fact, the clover was scarcely perceptible where no phosphate was sown. The statement made to me by the complete fertilizer agent that the "animal" bone would make the better showing in the future was not realized in this case, for no difference was and is noticeable.

The application of four hundred pounds of phosphate per acre two years ago resulted in an average yield of thirteen (13) bushels of wheat per acre last year upon a piece of land whereon two years previous the yield of oats was eight (8) bushels per acre, and whereon, the year still before that, white beans refused to yield the seed planted on a part of the field. In this case a part of the field was drilled with dissolved South Carolina rock, and the balance with a complete fertilizer. As was the case in the twenty-two-acre lot, so here no difference in the yield was discernible. A complete fertilizer, composed of seventeen hundred pounds of dissolved South Carolina rock, two hundred pounds of nitrate of soda and one hundred pounds of muriate of potash, applied to the oat field, at the rate of two hundred and fifty pounds per acre, last year doubled the crop, and the investment netted over one hundred per cent.

Other trials have given similar results to those named.

The results in some of the experiments referred to have been so marked that it leads us to conclude that our soil is peculiarly prepared for the reception of fertilizers containing a large per cent. of phosphoric acid. Our soil contains a fair per cent. of the fossil mollusca. It is probable that the actions of the atmosphere disintegrate minute particles of these fossils, and prepare it for the reception of the acid phosphate, and through this agent is converted into plant food.

This much is certain, that the phosphate acts upon *something* which has been lying dormant in the soil, for soil which will not, with the best tillage, produce a sufficient amount of grain to pay for the seed and labor expended will, by the application of a few hundred pounds of phosphate per acre, not alone pay for the seed, labor and phosphate applied, but give in addition a net profit. This *additional* product at least must be credited to the chemical changes of the soil through this agency.

Barn-yard manure would no doubt have a similar effect. However, since we have not enough of this to "go around," we may be consid-

ered very fortunate in being able to procure so cheap a substitute, and thus prevent some of our lands from becoming barren wastes, and restore others and make them valuable.

If the State Board of Agriculture had not done another act since its organization to benefit the farmers of this State except the enlightening of its citizens upon the fertilizer question, then every dollar expended by it from its inception has proved of tenfold value. As an example, a few years ago I bought some phosphate, for which I paid twenty-eight dollars ($28) per ton. The next year the "Tabulated Analyses of Commercial Fertilizers" fell into my hands, and it showed that the stuff was worth six dollars and seventy-two cents ($6 72). Consequently I was out of pocket twenty-one dollars and twenty-eight cents ($21 28) *on one ton! Can the amount of money saved directly by the farmers be estimated since the Board has taken the mattar in hand?* If so, show us the figures! It would do our eyes good.

But this is not all. The honest manufacturer (as well as the farmer) is benefited, for until we had some guide to judge of the value of fertilizers, we distrusted all manufacturers alike, and it is safe to add that the general introduction and use of phosphates would have been much slower than it has been, and hence the progress in agriculture in this Commonwealth much retarded.

F. DARLINGTON, Lincoln University, Pa. My experience in using fertilizers began in 1865, on an old worn-out farm, upon which during my three years of occupancy, I used four different brands of fertilizers, one proved worthless, but every application of the other three increased the crops of corn, wheat and grass from two to four fold.

In 1868 I came to my present farm, which at that time was considered to be in a high state of improvement. On applying the same class of fertilizers used on the other farm during a course of farming (seven years), but two of the eight fields showed any increase of crops from their use, but on these two, which were the latest cleared (stump land) the result was great. As the effect was so seldom, I had come to use raw bone principally. But finding through the next course of cropping that active phosphates were showing more generally, I applied more of them and less of bone. This change continued, and fertilizers have become a *necessity* (and have been for years) to *full crops* of all kinds. I think that the yield from my farm is one-third more than when I came to it. And I estimate that this is not above the proportionate increase from all the farms in this locality. We are all influenced by self-interest, which, in connection with fertilizers, is so great and varied that a full analysis of circumstances is needful to determine the exact amount of truth or facts contained in what farmers say about them.

Year after year I am surprised by unexpected results. But you ask for facts and these I am aiming to give. Another decade, another year, may show a different record. There seems to be no rule for the future. Every crop taken from the ground leaves it in a changed capacity for the next. It is for us to experiment diligently and carefully and note the results. It is for you (the State) to apply science intelligently, continuously, vigorously, protectingly, if agriculture is to be fully developed, or farming elevated. For farmers cannot be their own chemists, nor can the State, from one, two, or three experimental farms, furnish a formula for all farm operations. We must do the work. You aid and protect. And we should never lose sight of

this relation and responsibility. And how can we, when we remember how Jersey marl (that you told us was not worth a dollar), was sold to us year after year for forty-five dollars and fifty dollars per ton, recommended to be the "highest grade fertilizer," "perfect plant-food," &c., while we are unable to furnish a single testimonial of any benefit or effect produced by it. In this as in all other instances, your chemistry has proved itself worthy. And this result I ascribe to the use of commercial fertilizers. It does not seem at all probable that this increase of productiveness could have been brought about by the old method of farming, or if at all possible, at least not economically. As to the comparative effects of the different fertilizers, I will say that I have had no perceptible increase of any crop from raw bone the season it was applied, neither have I ever witnessed such result from bone applied by others. But the crops, from land to which bone has been freely and continuously applied, become more certain and greater, showing that bone is a slow but certain feeder of the soil.

Between South Carolina rock and "complete phosphates," I have marked no difference, have had no greater nor more lasting results from the latter, containing all the elements, than from the South Carolina rock alone with only the phosphate acid. While this has been my own experience (and I have made comparative trials for ten years), it corresponds with all the results I have witnessed around me. I am aware that many farmers combat this conclusion, but I have not met with any substantial testimony or facts to support the opposition, to become our rule of action.

GEORGE H. COOK, Greencastle, Pa. My experience of the use of commercial fertilizers for the last ten years was not without much thought and of importance, at least to me. Fourteen years ago I purchased a limestone farm near Greencastle, of two hundred and ten acres, which proved to be so exhausted that it would not produce over from nine to fifteen bushels of wheat to the acre. This, with a heavy encumbrance, set me to thinking, indeed. I then commenced the use of commercial fertilizers and was agreeably surprised at the good results, but at first not without some mistakes in selecting. The first season I used but few tons. Most of it was ammoniated and potash goods of high grade, or what is erroneously called a complete fertilizer, and a few sacks of Dissolved South Carolina rock or acid phosphate. In spite of my prejudice against the latter, I found it equal and in some trials even better than the so-called high grades. The high grade used contained from one and three-fourths to two and one-half per cent. ammonia, from three to four per cent. potash and from seven to nine per cent. of available phosphoric acid. The Dissolved South Carolina rock contained from thirteen to fifteen per cent. of available phosphoric acid. Now, from experience and from facts drawn from science, I concluded that my land was poor in phosphoric acid and that the acid phosphate furnished the needed elements of plant food more *largely* and for less *money*. I, therefore, during the last eight years used mainly the acid phosphate, from eight to ten tons in a year, and from one hundred and fifty to two hundred and fifty pounds per acre. Instead of having from nine to fifteen bushels of wheat per acre, I now usually have from twenty-five to thirty-five, and of better quality; the grass crops improve in proportion. At the two last tri-annual assessments the valuation of my farm was increased thirty-five per cent. This, of course, I did not like, but the blame was on the phosphate. Here in Antrim, on slate, as well as on limestone land,

the leading farmers chiefly use Dissolved South Carolina rock or acid phosphate, some even from twenty to thirty tons in a season. Its utility here is now hardly an open question. In many cases of trial the results have been almost incredible. One farmer, in the fall of 1885, who lacked confidence in fertilizers, sowed one-half ton of acid phosphate on part of a field he put in wheat after the corn was removed. The part fertilized made about fifteen bushels to the acre and the part unfertilized was, as he said, not worth cutting. All had the same advantage as to the soil and time of sowing. One other farmer, in a heavy soil, carefully measured off in a field two plots of just one acre in each and sowed at the same time both plots in wheat for trial, putting two hundred pounds of acid phosphate on the one plot and none on the other. While the wheat was growing there was apparently no difference. He cut and threshed each lot separately, and found that the lot fertilized made seven and a fraction more bushels than the lot unfertilized. A neighbor of mine while planting a lot in corn of about one acre dropped in with the corn two hundred pounds of acid phosphate. After the corn he sowed the lot in oats, and the oats in clover. The corn hills and rows could be distinctly seen in the growing oats, even at a considerable distance; so also in the first clover crop, and even in the second. The plant where the corn hill was grew so much taller and stronger. This not only proves the benefit of commercial fertilizers, but also that the fertilizer does not do, as some say, for one crop only, but that it improves the soil.

In our soil a complete fertilizer is not the most profitable. But I confess I have not yet seen a complete fertilizer, one that has all the elements of plant food and *in the right proportion:* nor would such be suitable to our wants, for the poorest soil is even rich in some elements of plant food. With the organic matter we have in our soil, and with the ammonia derived from the atmosphere, I think that we have all the ammonia we need to produce a crop. As for potash, my experience does not show that we are in need of it. I think that the potash which is made available by the disintegration of rocks and gravel sufficiently supplies the waste.

But phosphorous, we learn, is even at first but sparse in our soils, and then much of it is locked up in insoluble compounds and not available. Experience proves most emphatically that our soil is much in need of this element of plant food; and by selling off the grain we raise, and the live stock, we return but little of this element through our barn-yard manure. Therefore, we prefer to select that fertilizer which contains the greatest amount of available phosphoric acid for the money.

HOWARD PRESTON, Oxford, Pa. I have used almost exclusively South Carolina rock. In experiments made with other fertilizers, bone and complete phosphates, the rock gave equally good results, at near half the cost. My soil does not seem to need potash, and where a moderate application of stable manure was applied (ten two-horse loads per acre for wheat) enough of nitrogen was furnished to meet the requirements of the crops.

Buying, as I do, through an organization on a guaranteed analysis of fourteen per cent. of available phosphoric acid at fifteen dollars per ton, I know that I am not cheated.

Of the large quantities of commercial fertilizers used in this section, probably more than three-fourths is South Carolina rock.

For many years I have used from ten to twenty tons annually, and

the result has been entirely satisfactory, more than doubling the hay crop, and the increase of revenue from hay sold alone more than paying the cost of the fertilizer, while the amount of stock kept has naturally increased.

I am plowing a field this spring that has gone through the course indicated, and a better sod I never before turned under. When I compare it with what it was six years ago I cannot but be more than satisfied that South Carolina rock is a most valuable fertilizer.

Some farmers think it acts too quickly for corn, making a vigorous growth of stalk at the expense of the maturing ear. I have seen something of this, and propose this year to use bone and South Carolina rock side by side and note the result.

D. P. FORNEY, Hanover, Pa. The introduction and use of commercial fertilizers in this section of the State opens up many interesting agricultural questions for investigation and discussion. Nowhere in the State, perhaps nowhere in the United States, has the practice of fattening cattle for the spring market been so generally and so long adhered to. There will be shipped from the single station of Hanover alone about one hundred and fifty car-loads of fat cattle this spring, and other stations will contribute still more to the number. All the corn, oats, straw, and most of the hay are thus consumed on the farms, together with a large amount of bran, middlings, and some oil meal. One would suppose that with all this manure annually returned to our soil there would be little else needed to keep up its fertility, but, notwithstanding this, commercial fertilizers have been gradually introduced until the amount consumed is enormous. Now, then, rejecting the exceedingly common and cheap presumption that farmers are not capable of understanding their own business and can be easily instructed, singly or collectively, by any editors, lawyers, doctors, professors, or politicians who feel called upon to undertake it, and accepting the opposite presumption, that farmers, like, any other business men, understand their own business better than any body else, we must come to the conclusion that farm-yard manure alone, continuously applied, will not develop the highest productiveness of the soil. This conclusion is fortified by the opinions which I get from my most intelligent and reliable neighbors, men who annually feed from twenty to forty steers on their farms and haul out hundreds of loads of manure on their land who still say that where they apply a good commercial fertilizer their crops of grain and grass are improved by it, and our grain buyers tell me that the wheat is plumper, brighter and heavier. My own experience goes in the same direction. Be fore, therefore, endeavoring to decide which or what form of fertilizer is *the best*, a matter which I don't believe can ever be decided satisfactorily, would it not be more profitable to try and learn a little more about the manner of their action. We have here learned beyond reasonable doubt that commercial or mineral fertilizers always do best when applied with manure and not alone. The soil must be first considered, then the application. The intelligent physician considers first the patient, then the remedy. A great mistake has been made in trying to formulate a "complete manure" for the soil. It is about as successful as a "universal remedy" for the body and, like a "complete food" for the animal, it will only do where the capacity for digestion and assimilation are adapted to it.

Before the introduction of commercial fertilizers, lime was the great mineral manure of this section, and even yet by many it is re-

garded as a panacea for the soil. With its use, the farmers soon learned that it, too, always did best when applied with manure or on a good sod. It must have something to "act upon;" that was the explanation. To me the explanation always was exceedingly unsatisfactory. Lime, when applied to the soil in its caustic condition, as it usually is, will, in a comparatively short time, lose its caustic and solvent properties almost entirely. It returns to the insoluble carbonate and hydrate. This is seen in making mortar every day. Therefore we ought reasonably to expect that its best effects would be seen shortly after its application; but the reverse is true. Its effects are almost always most distinct a few years after the application; often as long as ten years after they are plainly visible. It must have time to "act," the old farmers say. Now, suppose we reverse this theory, and assume that the vegetable matter of the soil acts upon the lime and any other mineral food, instead of the lime upon the vegetable matter, and the whole theory becomes more reasonable. Hence, the longer and more intimately the lime is kept in contact with the vegetable acids, the more soluble and efficient it becomes. Chemistry teaches us that by the decay of vegetable and organized matter in and on top of the soil, nitric, humic and other vegetable acids are generated, and these are powerful solvents of plant food. Our soil here is a strong limestone soil, underlaid everywhere, at a greater or less distance, with limestone rock. This soil, geologists tell us, has been made up by the disintegration of the rock. Hence we cannot suppose there is any actual deficiency of lime in the soil. It is only wanting in proper condition for service to the plant, and this is brought about by burning the rock and spreading it again upon the soil; and so soon, therefore, as the soil gets as much as the plants need in this way, subsequent applications are superfluous and ineffective. Hence, after using lime for a long time, our farmers found the results unsatisfactory, and fell upon commercial fertilizers in its place, and the fact that their use is annually increasing indicates that in the main they are found profitable. The objection to their use is their uncertainty. No matter what the composition is, their use often fails to give satisfactory results, and this is perhaps as often true of the best as of the worst. What happens in the soil between the time you apply the manure, sow the seed and reap the crop, nobody knows. Mr. Lawes, whose opinions are entitled to more respect probably than any living writer on this class of subjects, conjectures that the decay of the manure in the soil is followed by the formation of "compounds of which we know little or nothing." Such an admission from such an experimenter deserves respect. Our agricultural literature is afflicted with a presumptious class of writers, who can always explain the puzzling problems and apparent shortcomings of the patient farmers with an assurance that is almost sublime. Mr. Lawes has come to that point in his accumulation of knowledge when he can admit his want of information. The man who "don't know" may some day find out; the man who "knows it all" never will. In the application of commercial fertilizers we must admit that we know very little. We must confine ourselves to what little we have learned by observation. In this locality we have observed that they do best when applied in connection with manure. This is likely owing, to some extent at least, to the solvent power of the acids which are formed by the decay of the manure. These prepare and digest the mineral food for the plant. It may be doubtful whether sulphuric acid can truly digest the South

Carolina rock for the plant. Without the intervention of the vegetable acids, there may be no assimilation, just as in the animal stomach there is none without the use of the gastric juices, and we may yet discover that the main point in a fertilizer is its mechanical reduction, leaving its solution to nature and her forces, and dispensing entirely with sulphuric acid. I have failed as often with "pure dissolved bone" and "Dissolved South Carolina rock" as with anything else, and have had good returns with ground bone without its dissolution with acid. This fertilizer I believe to be the best and cheapest in the end, from the fact that it contains more of what plants need than any other for the money, and yet I have seen it used without any perceptible benefit. In my own experience, I have found it very effectual when applied to meadow land, and the land then laid down to grass. I have taken four successive heavy crops of timothy off of such land. Another thing in this connection worthy of notice is that where the manure is applied on top it seems to make the fertilizer most effective, and what at first surprised me, its effects are more durable. Off of a twenty-acre field, which I mowed last year for the second time, and on which both superphosphate and Dissolved South Carolina rock were used three years ago, and part of the manure plowed down and part applied on top, after plowing, and then harrowed in, we took forty-three large four-horse loads of hay, averaging about one and one-half tons to the load, weighed out of the field, and the best was decidedly where the manure was applied on top. This, after what has been said, seems reasonable. The manure near the surface will decay more effectually than when plowed under, and will thereby render all mineral plant food with which it comes in contact more soluble and better fitted for plant nourishment. On a stiff clay soil this is especially important. Chemists have discovered that if you mix clay in a vessel of liquid manure it will retard putrefaction, whilst humus will accelerate it. For ulcerated sores, there is perhaps no remedy better than pulverized clay. I have found nothing better for scratches in horses. When, therefore, we plow our manure down on a stiff clay soil, we almost entirely arrest its decay and dissolution, and consequently we find it takes more manure on clay than any other soil. Applied near the surface, the sun and atmosphere assist in dissolving it from the plant, and hence we invariably get better results from keeping all fertilizers near the surface on such soils. One of my neighbors, a very successful farmer, plows all his wheat land as soon as possible after harvest, soils it down, and then draws all his manure on the surface, often being compelled to use five and six horses to his wagons to do it. He uses fertilizers largely.

The season when applied also has much to do with the success of a fertilizer. I have never applied any to oats (kainite excepted) without good results, and I have the impression that they are more profitable on this crop than any we have. This is likely owing to the fact that the ground is always moist in the spring, and all the forces of nature intended to produce growth are always more active then, and beside that, the roots of the oats, unlike wheat, all run near the surface, and are more likely to be affected by a fertilizer there applied. My conclusion is that they are always more certain in the spring on any spring crop than any other time. Applied in the fall, when the ground is dry, and the vital forces of nature are reduced to a minimum, they are always more uncertain.

As to what fertilizer is best, we appear to be almost entirely in the

dark. They all succeed sometimes, and fail at others. As a rule, potash fertilizers are least effective on our soil. I have tried kainite and ashes, leached and unleached, in almost every way, with no perceptible benefit, whilst those containing a large proportion of phosphoric acid usually give better results. Ever since the creation the forces of nature have been engaged in reducing the inorganic elements of the soil to such a condition as to fit them for plant food, and thus support the animal life of the globe. Just how this is done is one of the secrets of nature, which, like the sprouting of the seed, will probably never be revealed, and perhaps the best the farmer can do in the present state of our knowledge is to give nature a fair opportunity to carry on her work by furnishing her a generous supply of all materials to work with, and, meanwhile, we must rest content with the reflection that what we know about the matter, together with what we don't, comprises all there is of it, and if we can succeed in fixing the limits of the latter, we will have reached a point not easily attained on any subject.

J. K. MURRAY, Potts Grove, Pa. My experience with commercial fertilizers is about as follows:

I moved upon the farm on which I now reside about thireen years ago. The land was in a low state of cultivation, and, having been brought up to think that lime and barn-yard manure were all that was needed to improve a run-down farm, I, of course, commenced upon that plan. A trial or two with some fraudulent brands of commercial fertilizer, a few years before, did not change my opinion either.

But after five or six years' trial with lime and manure, I found my land but little better than when I commenced. I then gave up lime, but kept on feeding cattle to make all the manure I could. I tried several brands of commercial fertilizer, most of which I found to make quite a strong growth of straw, but very little increase of berry. And just on that point I think is where most farmers are deceived in fertilizers. They judge its quality by the looks of the crop in the field, when frequently there is no increase in bushels. Very few farmers go farther with an experiment than to leave a drill track or two without fertilizers and note the difference in growth. The proper way is to thresh and weigh the grain from each plot before a decision is arrived at. While I have not carried my experiments to quite that degree of perfection, I have come very near to it.

My method has been to note, as near as possible, how many dozen to the acre there were on each plot, and in what part of the barn each was stored, and then watch the threshing for the result. I found this method sufficiently correct to detect an increase of five or more bushels per acre I found that a fertilizer that contained ten or twelve per cent. of available phosphoric acid made a greater increase in bushels than one with less, even if it had a large amount of ammonia and potash. This led me to make some experiments with separate ingredients. In this I found that even on the same farm a different composition was required for different fields. But after several experiments with a complete fertilizer, one containing phosphoric acid and potash, and one which contained only phosphoric acid, I found that dissolved rock was the only fertilizer the land in that case needed. This experiment, however, was made on land capable of producing eighteen to twenty bushels of wheat per acre without fertilizer.

I have arrived at the conclusion that for land in fair condition, or where a reasonable supply of barn-yard manure is at hand, the only

commercial fertilizer that is needed is high-grade Dissolved South Carolina rock, with at least twelve per cent. of available phosphoric acid.

On worn-out lands a complete fertilizer will be needed, but in all cases a high grade should be used, and from three to five hundred pounds to the acre.

I have made no experiments with animal bone, but from the analysis of it I believe it would be an excellent manure for worn-out soils, and as profitable as any other kind.

R. S. SEARLE, Montrose, Susquehanna county, Pa. Our farmers have not, as a general thing, used them very much, but are beginning to in a small way. One great drawback to their use is the fact that our farmers have given but little attention to the subject, and do not take kindly to any thing new. Another drawback is the multitude of different brands, all claiming to be the best, and each agent running down most, if not all, other kinds but his own, especially those offered in his vicinity. And as the farmer hears all their stories, believes them all to be humbugs.

While the State Board ot Agriculture of Pennsylvania has, at great expense, attempted, and has put a safeguard around the sale of spurious fertilizers, the valuable *information* on the subject printed in their reports does not reach the greater number of the farmers, and they are not benefited by it. This is their fault, and will be remedied in time by the influence of institutes and farmers' organizations. While the great majority in this section have neglected the practical application of commercial fertilizers, a few have used them with varying results; but when judiciously used the results have been satisfactory. The use of them on new seeding in this section has been very satisfactory. Also when applied to corn and potatoes, oats, rye and wheat, and especially on poor soil with buckwheat in a test the past summer. A field of buckwheat was sown on poor soil, leaving a portion on which no fertilizer was sown, the remainder using two hundred pounds per acre of ammoniated bone phosphate. The result was a fine yield of good grain and straw where used, but not enough to pay for gathering where not used. Last fall a progressive young farmer in Bridgewater township used two thousand pounds on four acres of wheat and rye, seeding at same time. We await the result with interest. The field looked splendid when the snow came. I do not know of any one in this section having used Dissolved South Carolina rock, but have no doubt it would greatly assist our people. Many who attended our last Farmers' Institute came expressly to hear Hon. J. H. Hickman on this subject, and we were much disappointed. Still we hope to hear him in the future. Allow me to say in this connection that the benefit to our people derived from the two institutes held in Montrose has been beyond computation in dollars. Not only have they learned many lessons of practical importance that they will make haste to apply in their calling, but it has set them to *thinking*, and when men get to thinking good must result. The few dollars in cost to the State will be returned in the near future by advanced thought applied, with better crops, better citizens. Our principal dependence in this county is upon our grass crop, which we turn into butter, milk, etc. There has been no test in fertilizers on the meadows that I know of, but I shall fully test that part of it the coming season. Our winter has been unusually severe, snow still covering most of the ground.

A. P. YOUNG, Millville, Columbia county, Pa. In discussing the comparative value of Dissolved South Carolina phosphate, bone and com-

plete phosphate, I shall leave entirely out theoretical values or values that may have been determined scientifically, and confine myself to an estimate of the comparative worth of each, as demonstrated by actual test in the field.

Considering cost to results produced, I have no hesitation in saying that Dissolved South Carolina phosphate has been, on my soil, so far, the cheapest source of fertility. Whether a time, sooner or later, may come when this will not be the case, I leave for the future to determine, confidently hoping as soon as the necessity for a change is apparent to be able to see it and find what may then be needed.

The time was when intelligent farmers were misled into the belief that chemical science was able to tell them just what fertilizer or fertilizing materials were necessary to apply to a given soil in order to make it produce paying crops. Their claim has proven so unreliable as to be discredited, if not entirely discarded, by farmers, who have studied the sciences, take the papers, hold the plow occasionally themselves, and watch with as keen interest the effects of different methods, different rotations, different fertilizers applied in different ways, as the successful financier or stock broker watches the course of events likely to enhance or depreciate his investments. Chemistry may do much for the farmer by determining what elements are lacking or what are abundant; but the roots of plants running through tons of soil find abundance of needed aliment, where the chemist from his small sample is scarely able to find a trace.

To apply fertilizers successfully requires studious observation. The mode of application may cause failure; an unfavorable season may also cause the crop to go amiss when treated just as a previous one had been that was a grand success. An excellent fertilizer may thus be discredited, because the circumstances under which it acted were unfavorable. To apply a complete manure in large quantities or in quantities sufficiently large to meet the wants of a crop on a soil that needs only phosphoric acid or only potash is equivalent to borrowing and placing in bank a sum of money several times as large as we now see any necessity to draw upon. The same is true of a soil that responds to ammonical manure or any other needed element of fertility. If a man be famishing for a drink of water, shall we require him to take a full meal of solid food that he may be benefited by the little moisture contained therein?

While the complete manure man improved his fields by putting on what is not immediately necessary, there keeping a long bank account ahead, the specialist aims to supply what is now needed, and seeks ultimate improvement by calling to his aid nature's resources, carefully watching the effect of every application, not entirely with a view to immediate results, but to develop more and more, call down, and draw up, constantly storing at the right place additional fertility with each successive round of his rotation, never for a moment losing sight of the fact that the farm is not a store-house of unlimited capacity to honor drafts, but one that needs constant replenishing with those goods that are most in demand.

Commercial fertilizers of whatever kind are chiefly valuable in the impetus they may be made to give to the growth of grass, especially clover. With clover to reach up into the air and down into the subsoil for materials, commercial fertilizer judiciously chosen and applied will do much to aid in placing the best of plant food at the right place for the use of all crops. As a fertilizer to insure a growth of clover, I

have found nothing equal to the highest grade of South Carolina phosphate at same cost.

Experience thus far leads to these conclusions—that a fertilizer rich in phosphoric acid is of the first importance to crop production on my soil—that when a fertilizer of this kind has been applied along side of another, with a less quantity of this valuable constituent, yet high in its percentage of potash and ammonia, the result has invariably been that the increased production, when any increase has been apparent, has not been commensurate with the increased cost of the fertilizer. Repeated trials have been made with this invariable result.

E. REEDER, New Hope, Bucks county, Pa. I have been using commercial fertilizers in a moderate way for about twenty years, chiefly on wheat and potatoes. I have not used the South Carolina rock by itself. Most manufacturers, I believe, now use the rock as a base upon which to compound their fertilizers. It is rich in phosphoric acid, but does not contain potash or ammonia. I think that my soil requires a fertilizer rich in potash. *For wheat* I want a fertilizer that will analyze five to six per cent. of soluble phosphoric acid, six per cent. of potash and three per cent. of ammonia. I give a moderate dress of stable manure (ten two-horse loads per acre) and two hundred pounds of fertilizer drilled in with the wheat. When I do not have manure enough to cover the field, I drill the field both ways and apply from two hundred to two hundred and fifty pounds of fertilizer each way, making four hundred or five hundred pounds per acre. But a moderate coat of manure and two hundred pounds of fertilizer gives me the best results. Experiments made seem to demonstrate that my soil does not need strong doses of ammonia, hence I class that lowest in the list. The stable manure I think supplies about all that is needed of ammonia. *For potatoes* I want a fertilizer running from ten to twelve per cent. of potash, and I always have it mixed to order. Ever since I have been fertilizing potatoes in this way (six hundred pounds per acre in addition to a coat of stable manure) I have not missed a crop, and the quality is uniformly excellent. I think the fertilizer rich in potash for potatoes increases the yield and improves the quality.

G. HIESTER, Harrisburg, Pa. My experience in the use of commercial fertilizers has been rather limited, and I cannot speak accurately about results, as I have never weighed and measured the crops raised on a given area as compared with an unmanured plot. But from what I have seen I am convinced that we can use them with profit as a supplement to barn-yard manure. Further than this I am not prepared to go just now.

Our soil, which is a sandy and gravelly loam, seems to require the presence of considerable vegetable matter to give it just the proper consistency to produce the best results, and we find that commercial fertilizers are most effective when applied when a stiff clover sod has been turned down or when a heavy dressing of coarse manure has been applied the previous season.

If the mechanical condition of the soil is just right and the rainfall during that season is sufficient to dissolve them, we get excellent results; otherwise there is no perceptible difference where they have been applied and where they have not.

I have generally used complete manures, and have noticed a marked effect upon potatoes, corn, strawberries and market garden crops.

Have used the German potash salt (kainit) with great profit on

peach, apple and pear trees, and on potatoes and celery. Have never used Dissolved South Carolina rock.

I believe that by the judicious use of commercial fertilizers we can make our farms more profitable, but we must be careful not to place our entire dependence upon them, as many interested persons are urging us to do, but should use them as a supplement to a clover sod turned down or a dressing of barn-yard manure.

J. C. THORNTON, Avonia, Erie county, Pa. Speaking of the use of commercial fertilizers, the question is frequently asked: Does it pay to use fertilizers on our spring and fall crops? I am convinced it does. My first trial of phosphate was very discouraging. I used it on barley and oats on muck and sandy soil, and long before my crop was ready to harvest it was over half lodged down. The next spring I told the manufacturers of the fertilizers how it had worked for me. They said they would talk to their chemist and ascertain what I wanted. They done so, and made me a special lot that year, which done better.

Since then I have been using Dissolved South Carolina rock, nitrate of soda and muriate of potash. Mixed it myself as Professor Jordan advised in State Board Report, 1885. I vary the mixture as I think the different fields need it. Now I have no trouble with my crops lodging down.

This fertilizer is now used by several of our best farmers and is increasing every year. I am frequently told it is just what they wanted, and especially on warm, gravelly soil where the different brands of phosphates had done no good, but had done harm by being too heating. I do think if our farmers would try it, they would be well pleased with it at less cost than any fertilizer of the same quality in the market.

I drilled in last year forty acres of corn and used about two hundred pounds of this fertilizer to the acre, drilled in with the corn. It kept ground moist and wet along the row nearly all summer.

I never used Dissolved South Caroline rock alone, but intend to sow several tons this spring on my pastures and meadows.

I cannot praise this fertilizer too highly for the good it has done us here on wheat, oats, barley, corn and onions.

W. J. HOLLENBACH, Berne, Pa. (1.) It is about ten years since commercial fertilizers in the form of ordinary phosphates were first introduced in this section of Berks county. During the first few years of its introduction the farmer who made use of this class of manure was the exception; but its rich results on all crops has so established the confidence of the public that to-day it is safe to say that it is now used by ninety-nine per cent. of our farmers in variable quantities.

(2.) My own practical experience with this class of fertilizers extends to upwards of six years. The soil of my farm consists of a sandy loam, with a slight mixture of gravel, and of sufficient elevation to produce proper drainage.

(3.) During the first years of my experience I was inclined to use only cheap and low graded goods; but practice has taught me, so that I am now purchasing none but the standard and high grade ammoniated phosphates, for which I am paying from thirty-five to forty dollars per ton.

(4.) Before I used phosphate, barn-yard manure and lime made up my list of fertilizers, of the latter of which I applied large quantities annually; but of late I have lost all faith in lime as a fertilizer, and have quit its use for that purpose altogether.

(5.) When it is considered that lime is only lime, and contains

no manurial value or plant food in any degree, I am not surprised at the poor results it always gave me in crops in comparison to phosphate. In fact, I believe that lime is more injury than benefit to a crop of grain in a dry season. That it hardens the soil is very plain, because it is put into mortar for that particular purpose. In short, commercial fertilizers are more profitable to the farmer than any other class, because they save labor and time in applying and bring better and more desirable results.

I had cases already where, by the use of fifty dollars' worth of phosphate, I increased my wheat crop seventy dollars ($70), in comparison with where I had used lime or common barn-yard manure and no phosphate; and also in a number of cases the ratio of profit was even greater. To more fully test the true merits of commercial fertilizers in contrast to lime and stable manure, I at several times had occasion to use them all three on a crop of wheat alongside each other, all in one common field. The soil of the whole field was all treated alike in preparing it for sowing, and the seed all sown on the same day. I had the field divided into four sections. The first field was fertilized with phosphate, the second with stable manure, the third with lime, and the fourth was not fertilized at all. The proportion of results in the wheat crop to the acre were about as follows: The section fertilized with lime and the unfertilized section did not show any difference in crop yield; the manure fertilized section showed an increase of fifty per centum of bushels to the acre over the two preceding sections; the section fertilized with phosphate yielded an increase of one hundred per centum over the lime and unfertilized sections and fifty per centum over the one fertilized with manure.

(6.) Not only do I find the foregoing experiment in favor of phosphate true in wheat raising, but have tried it at a variety of other crops in different seasons and condition of soil, the results always being similar to the above. I therefore think, from these results, reaped by the using, and with the close experiments made with commercial fertilizers, and the rich results always obtained, I have a powerful argument in favor of its practice.

(7.) The greater quantity of phosphate I buy I apply to wheat. I usually sow my wheat the last week in September, with two and one-half bushels of the grain, and from two to three hundred pounds of phosphate to the acre in drills. I have proven that phosphate-grown wheat, as well as all other crops, will ripen at least a week earlier, and with much more regularity over the whole field; also, the grain is of a finer color, and more fully developed, and brings a better price in the market. The Hessian fly is also less apt to affect it when fertilized with this class of manure.

(8.) I am using it on oats, and the results are always very good. At corn I find it does admirably well. It produces a speedy growth, a heavy stalk and a well-developed ear.

(9.) This spring I tried it on potatoes. I dropped about a table-spoonful of the manure upon every potato before I covered it up with sod. The last row, my phosphate I had in the field did not reach out quite, and being too much trouble to bring out another bag, I left the remainder of the row unfertilized. The effects are plainly visible now. I can show you the very plant where I emptied my bag. There is a ifference of at least four inches in the height of the plants, and they have a rich, brighter color.

(10.) It is sometimes asserted that phosphate is only a temporary

fertilizer, and but of benefit to one crop. To this I would say that I know it to have benefited my grass crop in a profitable measure for two successive seasons in the same field after I had reaped the grain from it.

(11.) I never have tried "South Carolina rock" as a fertilizer, but from what I hear it does not bring very good results in this section.

E. SHORKLEY, Lewisburg, Union county, Pa. The steady and encouraging progress made in the various departments of commercial fertilizers to farming, seems quite apparent to the one who has been brought on for the last twenty years or more toward a practical use and knowledge, *mostly* from his own experiments and experience, and *wholly* on a line of his own necessity. Before the discovery of South Carolina rock, and at the time when nearly every small town with a machine shop and foundry had at least *one* mechanically inventive genius, putting up a bone-mill, more or less perfect; and when "pure animal bone" at twenty-five dollars per ton in sacks, and in the rough at half that price was abundant in some parts, just from the "out-of-the-way" places of the country and farms, then it was that the farmer who took the study of the phosphate problem without a teacher found himself confronted with overwhelming evidences of an expensive, laborious and troublesome undertaking. The farm upon which the herein results were painstakingly noted contains soil and fields of noteworthy variations in character and conditions. The low, underdrained, black and loose, the heavy clay, the uplands and the sandy; and on *all* these, by a careful system of weighing products and a prudent plan of purchase, the dissolved animal bone *invariably* gave better and more grain, grass and straw than the same amount of money invested in barn and stable manure from the farm-yard or town. The immediate demand for bone took it to a better market, and mixed goods and guanos were then for a time limitedly purchased, "and pure bone" at forty dollars was generally adulterated. The "phosphate" sack of those days, with its glowing set-off in print, covering *all* one side, would require more of a scientist to explain than would ever be at hand, and the *contents* of the same would be satisfactorily estimated by the reputed character of the house from which the goods were obtained. Three successive seasons were considered the best period of time to well established fixedness and reliability in any and every special test by which the conclusion was reached that phosphate of a high grade *always* paid and paid best. The meaning of "phosphate" in all statements herein made is a mixture containing available phosphoric acid, ammonia and potash, and in such proportions as to make the goods rank as "high." On sandy and light soil with wheat phosphoric acid alone for the investment has greatly excelled any other one ingredient. Where heavy clover had been plowed down, potash and phosphoric acid done better than phosphate and no clover in use of three-hundredths to the acre. The origin of the Pennsylvania State Board and its Chemist, in courtesy of its Secretary, came kindly and just in time to afford the most valuable aid, and at a juncture wherein the purchaser and all local agents were being innocently defrauded. Dissolved South Carolina rock was liberally cologned, colored and sold as "phosphate" and though measurably checked, an inexcusable defiance has often been detailed, and a few experiments thereby lost; but unlike aforetime, the general adulterations and their consequent faults are being placed at the door of the factory, and the users no longer, by common consent, classed with the *fools* on account of poor results from fraudu-

lent and unworthy "phosphate." The Board, through its deputies and the public press, turns attention to the phosphate laws, and after eleven years with the trade in mixed goods, aided in the use of all the legislative enactments, all the experimental farms can do, and all the information afforded by the most liberal scientists; yet it can well be said we have not obtained enough practical fact and knowledge to secure and hold a position of general welfare in the purchase and use of phosphate. It is the idea that phosphate in a certain sense is being believed by so many to be a *necessity*, and the agricultural press is brave enough *against* it to echo this, so as that in some way or another the accepted condition has worked serious ills in almost neutralizing our pioneer elements of work, and it is becoming questionable whether we are now progressing; and there is room for the belief that there are more difficult problems and more serious obstacles yet to overcome than we have already encountered. However, the last decade has variously decided in its impressive logic of events that the redeeming elements and forces of substantial progress in knowledge of and income *from* phosphate must come to us, if they come at all, by the way of a wise employment of the offers of legislation and coöperation. No *one* man in *farming* is likely *alone* to battle against the enemies of a fair and untried division of the great gains realized, and the open day view demanded of the mystery making manufacturers without in less than a quarter of a century seeking aid and sympathy in coöperative law and powers.

The line of actual land and crop test on any *one* crop, the facts to be brought out of commercial and real values and the sources of the plant-food ingredients are sufficiently problematic for the skill, patience and tastes of the most plucky and gamey of farmers, and past practice in testimony declares *not one* of *one hundred cares for or knows any of these vitally important truths* as coming of industry and diligent personal research. The last six years have with some few been faithfully and uninterruptedly given to a form of work calculated to. and did in *results*, simplify the phosphate complexity, and "standard phosphate" has been closely followed in its pretentions of quality and its subtility of mixture. This indefinite "some few" includes enough of the two classes—scientists and farmers—to be able to put plant food and plant feeding on a footing more readily understood and much more practically applied than in the generally adopted commercial methods which farmers have been *compelled* to accept. In the work referred to, South Carolina rock has been considered and purchased as the cheapest and best source of phosphoric acid; the nitrate of soda, our source of ammonia, and the muriate has been preferred for potash. Six years' test on winter wheat and rye gives confirmation of the following facts: These ingredients, with a certain uniform per cent. of purity, mixed with a shovel and a hoe, have in test with factory mixed phosphate *invariably* done best, and in some instances *vastly* better. Applied as for the immediate crop, dissolved slaughter house bone has been less profitable, and in "complete phosphate" the lower grades have been no better than Dissolved South Carolina rock alone. The cereals, corn, oats and buckwheat are crops on which tests have not been repeatedly made. Farmers raising potatoes have an opportunity for profitable experiment, not only to themselves, but for others, and on clay soil potatoes have been raised in the use of these chemicals at the cost of fifteen and eighteen cents per bushel—that is, the increase of crop by the application was enough in bush-

els to pay for the goods at the stated prices. This friendly force of coöperation has helped us out of the hands of unjust tribute and broken up old methods insomuch as that the copious showers of gain are fast filling up all the "old ruts" of our earlier dissatisfaction. In the amount purchased, at an expense of two and six-tenths cents per ton for the association's work, a saving of over *four thousand dollars* in 1886 gave an economic rainfall to our little phosphate union much calculated to encourage all honest and fair coöperative workers. The late *wave* of national legislation give leading agricultural scientists an almost enviable opportunity to be true, brave and faithful in their service for the "bread and butter brigade;" and if the Hatch experiment station bill fails to illumine the darkness of the phosphate question, then will our advance forces at home be justly censurable. This is not written to tell *any* one the best thing in phosphate for *them* to do, but recites what *one* actively aggressive farmer in a long pull has concluded to be the best thing *he* has done. No two farms, and but very few fields, in their need of plant food are alike, but they are alike in that they in soils differ, and that to raise paying crops greater and more direct help must be given than comes of the most judicious crop rotation. To the question, "What is the best phosphate?" answer may be made, "phosphoric acid, ammonia and potash." Now, suppose we wisely purchase them of a reliable dealer, and under the Hatch law we use *science*, and learn as much about these as anybody knows, as they are absolutely "phosphate," and every farmer has at his market a local agent for several *mixed* kinds, can we not in time by field, soil and crop tests "dig out" toward the light? Knowledge, coöperation and experiment are important factors in the avoidance of fraud and loss; and as this coöperative work and way is quite a departure, self and selfish modes are against it.

We, in wisdom, will *always*, upon a knowledge of the evils we are following, turn from them, and when made acquainted with the benefits of a change, will with our full heart and soul, in the exercise of a large heartedness and self-denying benevolence, *give up for the sake of others.*

In this "phosphate," as in every other department of our work, we must "farm" with our brains and ballots, as well as with our women and wallets.

M. S. COOK, Avondale, Chester county, Pa. It has been our custom for the past seven years to depend almost exclusively upon commercial fertilizers, using during that time many tons both spring and fall. We are to-day of the opinion that they are in this immediate locality a wonderful advantage to farmers. Our experiments have been principally with fine ground bone meal and South Carolina rock. After many very satisfactory experiments we have arrived at the conclusion that to mix these in equal proportions (as to bulk, not weight) and apply from four to five hundred pounds per acre, you will reap a profitable result. More can be advantageously used in some instances, but it has been a question with us whether from a financial standpoint a farmer can afford to apply greater amounts than we first mentioned. As a rule, to be sure, he must be governed by the condition of his land when he first commences to apply chemical fertilizers. If the land be quite poor and run down from excessive farming without the use of fertilizers of any kind, a large amount per acre, say even seven or eight hundred pounds per acre, will prove profitable to such a farmer. It has been our custom to apply about

the same amount for corn, oats and wheat, farming successively from corn to oats, and then grass, allowing the fields to remain in grass for three or four years without the use of any further fertilizers with excellent results, yielding from two to two and one-half tons per acre. We have tried other brands of fertilizers, but are decidedly of the opinion that bone and rock is needed in south-east Chester, as many of the farmers in this section agree. There seem, however, to be different fertilizers needed in different localities, as one soil requires one ingredient while another lacks in some other particular. We might state that it is only at present prices of rock that it proves so profitable, as a few years ago, when it cost from twenty to twenty-five dollars per ton, it was too expensive for results obtained by its use.

DAVID WILSON, Union City, Pa. We think that commercial fertilizers and barn-yard manures should never be looked upon as rivals. A good farmer should save everything from the farm that he can to increase its fertility and then lay by as much fertilizer as he can afford to, and that will increase the hay and straw, and consequently the manure pile the next year, and in this way keep up the fertility of his farm. To this end the carcasses of dead animals should not be allowed to go to waste. I have a neighbor who has built a cheap house in which he stores muck at his convenience and prepares it by mixing a barrel of lime and a bushel of salt to every cord of muck. When an animal dies or he can procure one from a neighbor he cuts it up and mixes it with muck, covering it at least six inches deep. Then after it has lain for a summer season fork it over and throw out the bones; then by the next spring it will be fit for use. If forked over once more in the meantime, all the better. The muck will absorb all the ammonia and let nothing escape. We think an old horse in this cheap way is made worth one-half ton of good phosphate. The bones can be gathered up and taken to a bone mill.

J. A. GUNDY, Lewisburg, Pa. My first experiment was the purchase of five large two-horse loads of *wool waste* from a woolen factory, on which the soap suds had been poured to increase its value. For this I paid three dollars per load, and hauled it two miles. It was without exception the most offensive article, as regards smell, that I ever handled. It was so offensive that before it was plowed under I smelled it distinctly at a distance of one and one-half miles when the wind was favorable. I spread it on my oats stubble, and plowed it under, sowing to wheat. I supposed I had a bargain, and engaged it for the next year, but on examining the crop of wheat the next year could find no favorable results. It was put on limestone soil of fair fertility. A neighbor about three miles distant on sandy river bottom had about a similar experience the year before. My next experiment was the purchase of three tons of superphosphate from some Delaware firm. This same phosphate was sold the previous year to a neighbor, who had drilled it in with his wheat in alternate acres, using phosphate on one acre and sowing the next without. The field of my neighbor was low, with a clay soil, but underdrained. The effect on this field was wonderful. During the entire next year the field looked like a striped carpet; the acres having the phosphate could be picked out as far as the field could be seen. The effect on this field is what led me to order the three tons. I drilled it in with my wheat, putting about two hundred and fifty pounds per acre. At several points I doubled the quantity for one round, and at several points made one round without any phosphate. The soil was a

gravelly red shale, with limestone underlying. The result was that I could not tell except by the marks on the fence where the phosphate was applied, or where it was not. It could not be told either on the wheat or grass. Cost of phosphate, thirty-five dollars per ton. Next I made a mixture of glue refuse, containing quite an amount of small bones that had been so softened by acid as to be quite easily crumpled in the fingers. Taking about two tons of this to one ton of pure ground bones, which I dissolved with sulphuric acid in the pile, after laying for some weeks, and shoveling over a number of times, it was run through an old threshing machine and sifted by a shaker. This contained nothing but flesh, bones and acid, and I thought it worth at least fifty dollars per ton. This I applied with the drill in sowing wheat, with no favorable results as far as I could see, although applied at the rate of from two hundred and fifty to five hundred pounds per acre. Many others used the same mixture, and mainly with the same results as mine. After this I tried several brands of phosphate and Dissolved South Carolina rock, sown broadcast on limestone soil in good fertility. In these but little difference was discernible to the eye either between each plot or between them and the adjoining pieces containing nothing. In the fall of 1885 I made a mixture consisting of seventeen hundred pounds of Dissolved South Carolina rock, two hundred pounds of muriate of potash, and one hundred pounds nitrate of soda. These were mixed together on the barn-floor by shoveling about for a number of times, and then drilled in with the wheat. The mixture was applied in three different fields. In the first, a good limestone soil in good fertility, and all of the field well manured, drilled in at the rate of two hundred to three hundred pounds per acre, showed no improvement over the spaces containing no phosphate, so far as the eye could detect; but most of the field was badly injured by the freezing of the plants where the snow was blown off. On another field of varying fertility, on the good land but little effect could be seen, but on the poorer parts, and where the limestone lay deep below the surface, the effects were quite marked, the grain being nearly or quite doubled in quantity. On the third field, one and one-half miles distant, gravelly and without the limestone soil, the fertility of which had been to a great degree exhausted, where no manure was applied, the effect was marvelous, the yield being at least twice as much as when no phosphate was sown; but where manure was applied the effect of the phosphate was observable, but not nearly so much as where no manure was applied. But in none of the foregoing cases was any certain measurements taken, and as a consequence are not as reliable as could be desired. Last spring (1886) I measured off twelve plots of one twentieth ($\frac{1}{20}$) of an acre each, soil a sandy loam, lying immediately on the limestone, in fair fertility; sod of clover and timothy, plowed in the spring, and after harrowing I applied as follows, all broadcast and harrowed in: No. 1, nothing; No. 2, ten pounds muriate of potash; No. 3, fifteen pounds dissolved bone black; No. 4, twenty pounds dried blood; No. 5, ten pounds potash and fifteen pounds bone black; No. 6, ten pounds potash and twenty pounds dried blood; No. 7, fifteen pounds bone black and twenty pounds dried blood; No. 8, ten pounds potash, fifteen pounds bone black and twenty pounds dried blood; No. 9, one-half two-horse load of yard manure; No. 10, two and one-half bushels burned lime; No. 11, one-half bushel (fifty pounds) grey gypsum; No. 12, nothing, each plot planted with corn of the same variety, and in the same man-

ner and on the same day, and in all respects treated exactly alike. Soon after the corn came up one could observe a difference in the color of the corn, the difference increasing as the summer advanced, and by July each plot to which potash had been applied could be picked out, at the distance of one hundred rods, by the increased size and color of the corn. The plot containing all three elements showed to the eye to be considerably better than the plot alongside, treated with manure. The corn was cut off and husked pretty early in the fall, but after it was fully ripe, and both corn and fodder weighed at time of husking. The fodder was not as dry as usual when stored in barn, and in consequence the results given below as to the fodder may be somewhat too high. Taking the average (and the difference was but little) of the two plots having nothing applied as the standard, the gain or loss of corn and fodder was as follows. The crop was very badly injured by a hail storm in July. Average yield of unmanured plots, one hundred and thirty-four and one-eighth pounds corn, and one hundred and forty-five pounds of fodder:

No. of plot.	FERTILIZER APPLIED.	Gain or loss of corn.	Gain or loss of fodder.
		Lbs.	*Lbs.*
2	10 pounds potash,	26½	70¼
3	15 pounds dissolved bone back,	10¼	20¾
4	20 pounds dried blood,	30¾	15¾
5	10 pounds potash and 15 pounds bone black,	51¼	92¾
6	10 pounds potash and 20 pounds dried blood,	62½	87¾
7	15 pounds bone black and 20 pounds dried blood,	21¼	21¼
8	10 pounds potash, 15 pounds bone black and 20 pounds dried blood,	62¼	110¾
9	1½ two-horse load manure,	37¼	77¾
10	2½ bushels burnt lime,	6¾*	7¼
11	50 pounds gypsum,	2¼	3¾*

* Loss.

It is intended to continue these experiments through the entire rotation of crops. From my experience and observation, the following deductions seem to be warranted:

First. That all commercial manures show better results on naturally poor lands or lands of exhausted fertility than on fertile lands.

Second. That phosphoric acid is valuable according to its availability, no matter wherefrom obtained.

Third. That on limestone soils potash appears to be the most effective and most needed elemant.

Fourth. That relative cost of purchase and application considered, complete fertilizers are more economical and remunerative than yard manure.

Fifth. That actual tests by weight are the only reliable tests of value.

Sixth. That tankage and similar products are of very little value.

Seventh. That lime and gypsum are no longer of value to our lands (although they once were), being stimulants furnishing no element needed by the plant and wanting in the soil, only making the elements in the soil immediately available, whereby they have enriched the fathers and are impoverishing their sons.

Eighth. I believe, although I have not tested it, that the needed supply of humus and of nitrogen can be obtained by using potash and phosphoric acid alone, and with these growing buckwheat, peas, clover, or other rapid-growing crops and plowing them down.

Future experiments may change these deductions but so far the evidence tends to establish them.

THE OCTORARO FARMERS' CLUB. Your committee, appointed to report upon the relative merits of the commercial fertilizers in the market, would most respectfully submit the following as the result of a careful inpuiry from different sections where the results from practical tests could be obtained without bias: Whilst some farms would use only bone or other high grade fertilizer, the almost unanimous expression, from an economic standpoint, is in favor of South Carolina rock. As an evidence of this fact, its increasing use and growing demand has in many sections of our country almost ignored the different brands of what are termed high grade fertilizers; the same is indorsed by the sales made at the various depots or shipping points within our knowledge. For example, at the sales depot at Atglen, conducted by John K. Melone, Esq., hundreds of tons of rock are sold annually, and scarcely one car-load of all other brands of fertilizer combined, in the same time. The same facts or indorsement at the warehouse kept by Bunton Walter, Christian, Lancaster county, whose sales of South Carolina rock amount annually to some five hundred tons, and only some thirty tons of all other grades of fertilizer. These goods are purchased and spread upon our land, and are judged alone by their previous good working qualities.

The Patrons of Husbandry, a progressive, economic, and intelligent class of farmers, purchase, in many instances, their fertilizers by the hundred tons, and almost invariably South Carolina rock; hence we are constrained to believe from these and other stubborn facts in connection with the increased productiveness of our broad acres in localities where these goods are almost alone consumed, that South Carolina rock, in connection with barn-yard manure, has played an active part in restoring our worn-out or neglected farms to a high state of fertility. By this we do not altogether ignore the different brands of phosphates on the market, as the bases of all are South Carolina reck; neither do we discard bone. The difference in their commercial value is greater than will warrant the consumer to pay for agricultural purposes and at the same time keep up a healthy bank account.

S. E. NEVIN, Landenburg, Pa. After some experience and observation of the use of commercial fertilizers, my practice is to sow five hundred pounds per acre of fine ground bone on the sod for corn.. South Carolina rock I use for oats at the rate of two hundred and fifty pounds per acre. I always leave several strips across the field in which no fertilizer is sown, and have never failed at harvest to tell exactly where they were. Barn-yard manure I use as a top dressing for grass; or, if I have any in the fall I use it for wheat, spreading it over as much of the field as possible. I then sow from two hundred and fifty to three hundred pounds per acre of bone phosphate over all the field. After the wheat is harvested I spread about forty bushels per acre of wood-burned lime.

In 1879 I spread on ten acres a very heavy coat of barn-yard manure made by grain-fed steers and kept under cover. On two acres in the same field there was no manure, and on this plot I sowed about four hundred pounds South Carolina rock and six hundred pounds

ground bone mixed. The wheat on the part manured started stronger, looked better all winter, and in the spring the two acres appeared so far behind that I sowed four hundred pounds more ground bone as a top dressing. At harvest there was no perceptible difference in the wheat. The field has not since been plowed, and the two plots can be distinctly seen. The one where the rock and bone was used has yielded the most hay, and the pasture is much better there than in the part manured. My business is dairying and raising stock and my object to increase the yield of pasture and hay, believing it was a wise farmer who said, "Seek ye first a good grass crop, and all other crops can then be added to it."

HENRY C. SNAVELY, Lebanon, Pa. While I have no exact data I can only give my experience in a general way, as their use affected the different crops to which I applied them.

As applied to wheat and rye during the last five years, an ordinary bone phosphate, or complete phosphate, if honestly prepared, has invariably been a profitable investment; making the increase in straw alone almost sufficient to pay for the fertilizer and leaving the increase in grain for profit, besides helping the grass out wonderfully for a year or two.

Having a good supply of yard manure, rich in nitrogen, by feeding wheat bran liberally, I have of late used pure raw, or pure dissolved animal bone, and either kainite or muriate of potash mixed with gypsum, thinking my yard manure supplied sufficient of the nitrogen. It is my opinion that most of our limestone soils are more deficient in phosphoric acid than either potash or ammonia, and for this reason I prefer a bone manure.

I used some South Carolina rock, but in too limited a way to express a decided opinion. Take the wheat crops of this spring, and I venture to say that the application of two or three hundred pounds of bone phosphate would have paid farmers many times over. I have a field, part of which was covered with yard manure, and part was drilled in with phosphate—well, the latter promises fifty per cent. better. These fertilizers give the plants a strong, healthy start in the fall, and will resist the changes of winter and spring better. From present appearances it would have paid me very well to have applied phosphate to every acre seeded down.

It would be well if we knew in what our soils were deficient, and then apply largely of it, but this can only be learned by experimenting, or an analysis of the soil.

I find bone and potash more profitable in the cultivation of berries and peaches than yard manure. If I could get all the yard manure I wanted for nothing, and I want a great deal for mulching, I would not think of growing a firm, highly colored, and well-flavored strawberry without applying bone and potash. I know that a berry thus grown will hold up in the basket twenty-four hours longer than the one grown exclusively with yard manure. The crop may not be larger, nor the fruit, but it will be superior every way.

Dissolved bone and kainite make an excellent fertilizer for potatoes; the plan is to broadcast some of the mixture, then before planting throw out a deep furrow, put in sets and cover lightly, and sow fertilizer over the row, and work in more soil.

THE DAIRY AND DAIRY MATTERS.

FRAGMENTS—INCLUDING DAIRYING IN THE NORTH-WEST.

By M. W. OLIVER, *Member from Crawford county.*

After miraculously increasing the nutritive power of the five loaves and a few small fishes to an amount sufficient to satisfy the hunger of the thousands who had gathered to hear and be healed, the greatest teacher and wisest counsellor that ever lived upon the earth, said to his disciples: "Gather up the fragments that remain." Why? That they might have them to satisfy their hunger on the morrow? No! That they might sell them in the market? No! The simple reason was "that nothing be lost." In these four simple words "*that nothing be lost*," is a mine of untold worth. This, in short, answers the question, Why are fragments worth saving? Because they have a value and therefore should not be lost. We are often assured "that no particle of matter under Divine supervision is ever lost." If this be true, then certainly no fragment of any kind under human control should be lost, because it has value, the amount of which is to be determined by circumstances. In the fragments which the disciples were commanded to gather up there must have been a value, or He who understood the relation of things, one to another, perfectly, would never have given this command.

It is sometimes said "Life is made up of fragments." If this be true, may it not be well for us as farmers, dairymen, or men of any other calling, to consider for a few moments, at least, some of the fragments which we are losing, but which if gathered up and put to proper use, would represent a value of no small amount. Among the many fragments lost are fragments of time, of material, of force, of energy, of experience, of opportunity and of moral character. So inseparable are these, the one from the other, that any waste of one involves waste of another, therefore the consideration of these must go hand in hand together.

The engineer who puts on more steam than is necessary to insure his safe arrival at a certain point at the required time wastes not only water and fuel but the wear of machinery, and more than this, the nerve power of the passengers also. He who loses fragments of the early morning, the most valuable time of all the day, thinking he can regain it before night, generally fails in his calculation, for late rising, on the farm at least, causes irritability and with it a general uncomfortableness during the entire day. The farmer starts hurriedly to the field, to find that he has left some important article at the house or at the barn; a fragment of time is lost in returning for it, and with it a fragment of opportunity and of strength. How many fragments of opportunity are lost? One writer has said: "Tell me what a farmer does with his so-called leisure hours and days of winter, and he can, in some measure, predict his success in the busy days, seed time and harvest." Winter is the time for planning, as the summer is the season of execution. Winter is the time for thought, as the summer is the season for carrying thought into action. It is the way that farmers open their winters that makes them long or short

headed. It is he who carries in thought one season over to the next that makes his ends meet and lap. It is he who sees the end from the beginning, who works from the beginning towards that end. Every farmer should sow every crop and harvest every grain field while the soil is bound in the icy fetters of winter, and the seed from which that crop is to spring is still in his granary. He should plan his whole coming season's agricultural campaign during the long winter evenings, so that when the spring opens he may put his forces into the field and lead them wisely and well. As the great farmer, soldier and father of his country has said: "In time of peace prepare for war." Fragment of experience in the feeding of stock, especially young stock, is sadly allowed to go to waste. Especially is this true during the winter months. Too many keep their young stock through the winter months without gaining, by furnishing them with the food of support only. It is to lose entirely the winter's food and care, besides the permanent injury to the animals, by stunting them in their growth in some degree, and from which they are rarely able to recover fully, and even if they do so, it takes a considerable portion of the next summer's food to accomplish it. English farmers have for some years been reducing the age at which to market beef, and have so far succeeded that much of their stock is now sold at from twelve to twenty-four months old, and it has been found quite satisfactory to both dealers and consumers. Their experience, together with the successful feeders in our country is, that early maturing stock with full feeding from birth, and marketed at the age above mentioned is where the greatest profit lies. It has been demonstrated time again that a pound of flesh can be put on an animal at less cost during the first twelve months of its existence than at any subsequent time, and that the cost increases month by month. The production of this young beef should command the attention of our farmers, for if it pays in England it ought, with our facilities, to show good returns here. To make the largest amount of beef, pork, or mutton, in the shortest possible space of time, and also the biggest pile of manure, should be the aim of every farmer. It is the road to his success.

The winter feeding of stock is a question of the highest importance to the farmer and dairyman, and one on which more definite information is desirable. The opinions and practices of feeders vary so greatly, even in the same section, that nothing seems to be settled that will be applicable to all sections. The relative cost of food and labor will in some parts of the country be the pivot upon which the question will turn, and each farmer, from his own standpoint, must by careful study and experimenting decide what is best for him in his situation. Nevertheless, there are some general principles that govern it, and are applicable everywhere and under all circumstances. Prof. Cameron well says: "A knowledge of the kind and quantity of food required by animals may be gathered from the composition of the several parts of the animal body and a study of the functions they perform. The muscles must be sustained, therefore gluten, albumen, etc., popularly called muscular matter must be eaten. The fat of the body must be renewed, therefore fat should be represented in the food, and as much carbon escapes from the lungs and skin, it seems natural and necessary that starch or sugar should be introduced into the stomach with a view of supplying it. The minerals of the flesh, blood and bones must be in like manner provided." This is essentially true; and just here is where science comes to our aid, in showing us

by analysis the constituent properties of cattle foods and their equivalents; showing how to combine albuminoids with fat forming elements and minerals with proper proportions to obtain the best results; and at the same time a great saving may be made in some kinds of food which would be fed to excess, while that actually required to make a well balanced food, might be, without this knowledge, unwittingly withheld. Many dairymen have been a long time in learning, while some have not yet discovered the fact, that the best butter ration must have a larger proportion of albuminoids or nitrogenous food than for the production of quantity of milk. Clover is one of the most nitrogenous of our fodders, and should, therefore, be more generally grown by our dairymen. Warmth and shelter are large factors that enter into the question of winter feeding and care of dairy cows, as well as all animals, insomuch as the animal system is, like a steam engine and boiler, continually consuming fuel in the shape of food to keep the animal machine in working order. Just how much heat is the equivalent of food is, of course, not certainly known. Experts estimate the saving at one-quarter. However wide or close this estimate may be, as to the truth, there is no one point more generally admitted among dairymen than the fact that cows exposed to the rigors of winter will not do as well as those properly cared for and comfortably housed.

But, I was to say something about dairying in the north-western part of the State. Its history is not unlike that of other portions of the country. Crawford county is comparatively a new country, or more particularly the western half of it. The first female white child born in this half of the county is still living, and is not yet an hundred years old; so that in some portions of the State, as well as in other States, dairying had made some progress and was being carried on somewhat as a specialty, while as yet this part of the country, and, I may add, a considerable portion of the North-west, was unimproved. When we review the history of dairying we are surprised at the wonderful progress which it has made. It was not till 1857 that the associated system of dairying was given birth. Since then its peculiar features have been spread over the entire continent. This system of dairying has given rise to the establishment of dairy associations and a literature for the dairy, and we find that for the decade from 1855 to 1865 the question of milk and its products began to be more thoroughly investigated and to be treated in a scientific manner. During this period the manufacture of cheese was becoming shaped into a regular system and our dairy products assumed a uniformity hitherto unknown to the dairies of America. During the year 1864 and 1865 the price of cheese went up to what was considered to be an extraordinary figure, while the factory system commended itself more and more to old dairymen, and the plan was found to be especially adapted for introducing the dairy into new districts. In 1859 the total exports of American cheese were only 9,287,000 pounds, but in 1861 they had risen to 40,141,000, and in 1864 to 49,755,842 pounds, a quantity at that time thought by many to be near the limit of our production. In 1859 the average price of cheese was in New York city eight and one-half cents; but in 1861 it had dropped to seven cents, while in 1864 it had risen to fifteen and one-half cents. Butter brought in 1859 eighteen cents, in 1861 fourteen cents and then advanced to twenty-four cents in 1864. The period from 1865 to 1875 is known throughout the United States as "flush times."

It was a period of inflation. Men "made haste to get rich." The wildest schemes of speculation were inaugurated. Money was squandered recklessly in all kinds of extravagance. Fictitious values were put upon all kinds of property, personal and real, and many, instead of paying debts, invested their surplus earnings in railroad bonds and stocks, which, in a short time, proved worthless, and in this way many millions of dollars were wiped out. In many parts of the country good dairy farms were not infrequently considered a bargain at from $100 to $200 per acre. Persons with a few thousands of dollars were often eager to purchase dairy farms at high prices, and they, in consequence, became hopelessly involved. Cheese in 1865 had risen to an average price of twenty cents per pound, and it continued to bring from sixteen to eighteen cents until 1872, when it dropped to thirteen and one-half, the lowest point during this decade. But it advanced to fourteen and one-quarter in 1873 and to fourteen and three-quarters in 1874. It was during this decade that butter factories and creameries began to attract attention and to spring up in widely separated localities. Fancy butter not infrequently was sold at a dollar per pound. The average price of butter in New York in 1865 was forty-five cents per pound. In 1866 and 1867 it was but thirty cents. In 1868 it was again forty-five cents, when it gradually declined to it lowest price—fifteen cents—in 1872. It closed the decade at twenty-seven cents. It was during this decade that the associated dairy system was carried to Canada, being first established at Ingersoll in 1867; and all through this decade it was largely patronized at its annual conventions, receiving aid from the government. In this decade, also, dairy associations were established in the Eastern States, in Ohio and Illinois, and in the North-west, and the annual conventions brought out large numbers of persons to attend the meetings, the gatherings not unfrequently numbering 500 persons. By the published reports of these conventions, and by books on the dairy, as well as writings in the agricultural papers, dairy literature began to take prominence and to compare favorably with that of any branch of farm industry. It seems hardly necessary to speak of our increased production and the commercial history of the dairy during the past ten years. It is fresh in the mind of every one engaged in this interest. Dairymen have felt at times the extreme pressure of low prices; at other times they have felt to congratulate themselves on the fair prices obtained for their goods. For a considerable portion of this decade, however, the result has been that neither producer or buyer has made much money to boast of. Our dairying in the north-western portion of the State is unlike yours here in the eastern, in that ours (associated dairying) is the production of cheese, while yours is the making of butter.

The first factory built in the North-west was in 1865, and within five years thereafter in the counties of Erie, Crawford and Mercer, there were nearly one hundred factories in active operation, each receiving the milk of from 200 to 600 cows, some factories making daily from twenty to twenty-six cheeses of an average weight of sixty pounds. This industry gave a new impetus to the clearing up of our lands, and, while we have considerable of wood lands yet remaining, we have no more than will be sufficient to meet the demands for fuel and building purposes—not much more than what the sanitary laws should demand in every part of the State. At first the factory system had much to contend with. Some patrons seemed to think that anything bearing the name of milk was good enough to take to the factory, and then

some of the factorymen had never learned that "cleanliness was next to Godliness," much less had they learned that cleanliness was essential to the making of good cheese. Hence, when a factoryman who did demand good milk rejected some that was unfit to work up, he quite likely lost a patron, which patron was gladly accommodated at another factory not so scrupulously clean and exacting. Patron and factoryman alike had to be educated. They found their interests were not dissimilar, but that they were in common. Factorymen found their goods had to be sold, if sold at all, upon their merit, hence the importance of attaining as near perfection as possible in their make of cheese to secure the top prices, and thereby give satisfaction to their patrons. The wide margin of difference in price between strictly fine butter and cheese and the lower grades, as quoted in the market reports, was a sufficient evidence of this fact. Though the establishment of this associated system of dairying was during the "flush times," yet the fact became patent that it did not pay to manufacture anything but the best article; that all inferior goods were manufactured at a loss. It became, therefore, the interest of the producer to inquire into the causes of the production of so large a quantity of inferior goods, the result of which was that each patron was required to give special care to his milk pails and cans; see that they were thoroughly cleansed and scalded; thoroughly brush the cow's udder and clean it of all foul matter, and under no circumstances to allow the cow's teats to be wet with the milk for the purpose of softening or cleaning them. This is a very filthy habit and should never be allowed. The cows were not to be hurried or worried by dogs in driving, and if perchance the cow sometimes became heated, she should be left unmilked till she has cooled off and gotten over the excitement. Should the cow be ailing or out of condition, her milk should go to the swill barrel rather than to endanger a whole vat of milk. In fact, the patron was to do everything he could to secure to the cheese-maker good, sweet, pure, wholesome milk. He should never leave his cans in the barn while milking or over night. It will almost invariably taint the milk. The patron should also demand from the factoryman the utmost care and neatness in all his work. These are some of the general rules which are being insisted upon in the handling of milk. In the increased make of dairy products, the market can find no place for inferior sorts at anything like living prices to the producer. They are, and will be in the future, slow of sale, if not next to unsalable. The demand is for fine goods, and that demand must be met, and it will be met by those who have resolved upon standing firmly by the dairy industry; who are intelligent as to its needs, and who have faith in its future prosperity. With a uniformity of fine goods, both in the home and foreign markets, consumption may be so promoted and increased that our dairy industry will again be lifted into a highly prosperous condition.

OUR DAIRY INDUSTRIES.

By EASTBURN REEDER, *member from Bucks county.*

Agriculture is the foundation industry, not only of the State and the nation, but of the world. It is the most ancient and the most important of industries. It was Washington who said: "Agriculture is the

most healthful, the most useful and the most noble employment of man." We have in the United States, according to the census of 1880, a population of 50,155,783. We have 4,008,907 farms, of an average size of 134 acres each. We have in these farms a total of 636,081,835 acres of land, of which 284,771,042 acres are improved farm land. Living upon these farms and engaged in the pursuits of agriculture are 7,670,493 persons, or one-seventh of our entire population. The total value of our farm products or agricultural productions is $2,213,-402,564. Here we have presented a concise but clear view of the great magnitude of our agricultural interests. Let us compare it with some of our principal manufacturing industries. Let us first compare it with all of them combined. We have in this country 253,852 manufacturing establishments of various kinds. These establishments give employment to 2,738,895 hands, or about one-eighteenth of our whole population. The total value of raw material used is $3,396,823,549, and of manufactured product $5,369,579,191. Here we see that the total value of our agricultural productions is very nearly equal to one-half of all our manufactured products combined. And it must be borne in mind that this total value of manufactured products includes the manufacture of agricultural products as well as the manufactured products of industries other than agriculture.

Let us next ascertain the magnitude of our dairy interest as a part of our agricultural interest. We have in the United States, upon these lands of ours, 12,443,120 dairy cows. We have also on the same 22,488,550 other cattle. If now we value the cows at $30 each, we have the sum of $373,293,600 as their value, and the other cattle at $20 each, we have as their value $449,771,000, making a grand total for dairy stock and beef cattle, $823,064,600, as a portion of the capital stock invested in our dairy interest. The proportion of our lands devoted to dairying, and the value of the same I shall not attempt to determine. Neither shall I bring into the account the value of dairy machinery and appliances, but shall content myself with a statement of the amount and value of our dairy products. The amount of butter made was 777,250,287 pounds, of cheese 27,272,489 pounds, of milk consumed other than that made into butter and cheese, 530,129,755 gallons. If now we place values upon these products, valuing the butter at twenty-five cents per pound, the cheese at ten cents per pound, and the milk at twelve cents per gallon, we shall have a statement like the following:

777,250,287 pounds of butter, at 25 cents per pound, ...	$194,312,572
27,272,489 pounds of cheese, at 10 cents per pound, ...	2,727,248
530,129,755 gallons of milk, at 12 cents per gallon, ...	63,615,570
Making a total of, ...	-260,655,390

As the annual cash value of our dairy products.

Let us next contrast this with some of our other leading agricultural products, as well as with some of our principal manufacturing industries.

Hay.—The quantity produced was 35,205,712 tons. If we value this at $10 per ton we have as the value of our hay crop $352,057,120, being $91,401,730 more than the value of our dairy products.

Corn.—The quantity produced is 1,754,591,676 bushels. If we value this at fifty cents per bushel we have as the value of our corn crop $877,295,838, being $616,640,448 more than the value of our dairy products.

Wheat.—The quantity produced was 459,483,137 bushels. If we value this at one dollar per bushel we have as the value of our wheat crop $450,483,137, being $198,827,747 more than the value of our dairy products.

Lumber.—The value of the logs is $139,836,869, and the total value of all sawed products is $233,268,729. This is $27,387,661 less than the value of our dairy products.

Coal.—The product of the anthracite coal is 28,621,371 tons, valued at $42,139,740. The products of bituminous coal is 41,860,055 tons, valued at $52,427,868. The total value of all the coal being $94,567,-608, which is $166,087,782 less than the value of our dairy products.

Iron Ore.—The quantity produced is 7,064,829 tons, valued at $20,-470,756, which is thirteen times less than the value of our dairy products.

Iron and Steel.—We have for the manufacture of iron and steel 1,005 establishments, the total value of materials being $191,271,150. The total value of all the manufactured products is $296,557,685, which is about $30,000,000 more than the value of our dairy products.

Cotton.—The quantity produced is 1,570,344 bales, or 750,343,981 pounds, valued at $102,206,347 as the cost of materials. The total value of the manufactured products is $192,090,110, which is $68,565,-280 less than the value of our dairy products.

Gold and Silver.—The total product of gold was $33,379,663, of silver $41,110,957, and of both $74,490,620, which is $186,164,770 *less* than the value of our dairy products.

We have as the value of our gold product $33,379,663; we have as the value of our butter product $194,312,722, the value of the nuggets of gold being very nearly six times *less* than the value of the golden nuggets of butter.

So far we have been comparing the productions and interests of our whole country, the United States. Let us now turn our attention for a few moments to those of our State of Pennsylvania.

Population.—We have in Pennsylvania a population of 4,282,891. We have 213,545 farms, of an average size of 93 acres each. We have engaged in agriculture 301,112 persons, about one-fourteenth part of our entire population. We have as the total value of all our farm products $129,760,476, which is an average of over $600 for each farm.

Our Dairy Interest.—We have in this State 854,156 dairy cows; we have also 861,019 other cattle. If now we value the cows at $30 each, we have as their value $25,624,680; and if we value the other cattle at $20 each, we have $17,220,380 as their value, making altogether $42,845,060 as the value of our dairy and beef cattle. Our butter product of 79,336,012 pounds, worth, at 25 cents per pound, $19,834,003; our cheese product is 1,008,686 pounds, worth, at 10 cents per pound, $100,868; our milk sold and consumed other than made into butter and cheese is 36,540,540 gallons, worth, at 12 cents per gallon, $4,384,-864, making altogether as the value of our dairy products of milk, butter and cheese $24,319,735, which is abont one-fifth part of the total value or all our farm products. The entire value of our dairy products and cattle is $67,164,795, which is more than one-half of all our farm products.

Let us next compare the value of our dairy products with a few of our leading farm crops as with some of our principal manufacturing industries.

Hay.—The quantity produced is 2,811,654 tons, worth, at $10 per

ton, $28,116,540, which is $3,796,805 *more* than the combined value of our dairy products and $8,282,537 *more* than the value of our butter product alone.

Corn.—The quantity produced is 45,821,531 bushels, worth, at 50 cents per bushel, $22,910,765, which is $1,408,970 *less* than the value of our dairy products, and only $3,448,360 more than the value of our butter product alone.

Wheat.—The quantity produced is 19,462,405 bushels, worth as many dollars, which is very nearly, but not quite, equal to the value of our butter.

Lumber.—The value of the logs is $13,378,589; total value of all sawed products, $22,457,350, both being *less* than the value of our dairy products.

Iron Ore.—The quantity produced is 1,820,561 tons, worth $4,318,999, being about one-seventh part of the entire product of iron ore of the whole United States. The value of the iron ore is about one-sixth part of the value of our dairy products.

Coal.—The quantity of anthracite coal produced is 28,612,595 tons. It is worthy of notice here that almost the entire amount of anthracite coal produced in the United States comes from this State, with the exception of 6,000 tons from Rhode Island. The quantity of bituminous coal produced is 18,075,548 tons, which is nearly one-half the product of the whole country. The value of the coal is $42,116,500 for the anthracite and $18,267,150 for the bituminous, making altogether $60,383,650. This is not quite equal to the value of our dairy stock and their products.

We have thus compared our dairy products with our chief farm crops of hay, corn and wheat, and with our chief industries of lumber, iron and coal, and ascertained their relative values and importance. Since 1850 the census reports show a steady increase in the quality of butter, and a corresponding amount in the decline of cheese. The table stands thus:

	1880.	1870.	1860.	1850.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Butter,	79,336,012	60,834,644	58,653,510	39,878,418
Cheese,	1,008,686	1,145,209	2,508,556	2,505,034

The cause producing this great change will certainly be an interesting, and may prove an important, object for our study.

The principal dairy counties in the State are Chester, Montgomery, Bradford and Bucks. Prior to the taking of the last census, Bradford county occupied the front rank, and as a butter producing county she still heads the list; but when we come to take into the account the value of the milk sold and cheese made, she must step down to the third place. The value of the dairy products in these four counties is as follows:

1—Chester county.

Butter,	4,246,665 pounds, worth	$1,061,664 00
Milk,	5,758,815 gallons, worth	691,057 68
Cheese,	11,296 pounds, worth	1,129 60
Total for Chester county,		$1,753,851 28

2—Montgomery county.

Butter,	4,166,479 pounds, worth	$1,041,619	75
Milk,	5,534,032 gallons, worth	664,083	84
Cheese,	342,004 pounds, worth	34,200	40
Total for Montgomery county,		$1,739,903	99

3—Bradford county.

Butter,	4,824,656 pounds, worth	$1,206,164	00
Milk,	469,112 gallons, worth	56,293	44
Cheese,	19,204 pounds, worth	1,926	40
Total for Bradford county,		$1,264,383	84

4—Bucks county.

Butter,	3,892,430 pounds, worth	$ 973 107	50
Milk,	2,307,554 gallons, worth	276,906	48
Cheese,	11,859 pounds, worth	1,185	90
Total for Bucks county,		$1,251,199	88

Dairy Methods.—Previous to 1880 dairying in Bucks county was confined to the farms where the cows are kept. Since that time our farmers have rapidly gone into the creamery system. A year ago we had thirty-five creameries in operation—more than any county in the State. We all know the advantages and the disadvantages of the creamery system, and it is needless to go into a consideration of that question. The growth we have made, from no creameries in 1880 to thirty-five in 1885, is most extraordinary. This method of dairying, however, in common with all other methods, has yearly grown less and less remunerative. The statistics of my nearest creamery show how gradual and constant this decline has been:

	PAID FOR MILK.	Rec'd for butter.	Rec'd for cheese.
1882,	$1 30 per 100 lbs.	$0 37	5.85 cents.
1883,	1 29 per 100 lbs.	32	5.63 cents.
1884,	1 17 per 100 lbs.	80	5.03 cents.
1885,	1 04 per 100 lbs.	27½	2.63 cents.

Here we see that in four years the price of butter has fallen from thirty-seven to twenty-seven cents per pound, and of cheese from 5.85 to 2.63 cents per pound—causing a corresponding decline in the prices paid patrons for their milk from $1 30 per one hundred pounds to $1 04. The present outlook is not encouraging and many farmers are seriously considering whether to continue the keeping of cows.

For the benefit of those not acquainted with the creamery system, the following statement of the operations of one of our creameries for a year is thus given:

1885—Quantity of milk received, 2,629,920 pounds. Price paid for milk—highest price $1 40, lowest eighty cents, average $1 04. Whole amount paid for milk, $26,-243 62.

Received for butter sold,	$28,569 25
Received for cheese sold,	998 63
Received for skimmed milk sold,	1,752 13
Total receipts for milk, cheese, butter,	$31,320 01

Quantity of butter made,	104,516
Quantity of cheese made,	37,875

The highest price received for butter, thirty-seven cents, lowest, twenty-two cents, average, twenty-seven and a half cents.

The low price of cheese induced the managers to resorting to sell the skimmed milk to patrons and others for family use, and for feeding to

calves and pigs, so that the receipts from this source exceeds the amount received from the sale of cheese, which is strictly skimmed-milk cheese. The quantity of milk required to make a pound of butter was twenty-five pounds, or four pounds of butter from one hundred pounds of milk.

Profits in Creamery Dairying.—When John I. Carter was asked at the last annual meeting of the State Board of Agriculture to give the the profits of the creamery system, he replied: "We pay three and a half cents a quart for milk; nine quarts of milk makes one pound of butter, and we get forty cents a pound for our butter; make your own calculation." The result of this is the milk for a pound of butter costs thirty-one and a half cents, leaving eight and a half cents to pay for labor and profit. This of course was the price January, 1886. Let us see how it works when applied to a Bucks county creamery for the year 1885. Price paid for milk per one hundred pounds, $1 04; quantity of butter made per one hundred pounds of milk, four pounds; price of butter per pound twenty-seven and a half cents, for four pounds, $1 10. In this case the profit on four pounds of butter is six cents, but in neither calculation is the value of the skimmed milk estimated, either for cheese making or for feeding purposes.

A glance at our statistics for 1885 shows that the price paid for milk was $26,243 62; amount received for butter, cheese and milk $31,320 01; leaving a balance of $5,076 39. This sum represents the amounts paid for labor, running expenses and also the dividends paid to the stockholders.

Dairy Breeds.—I cannot well close this branch of the subject without a few words in relation to breeds. Every breed of cattle has its advocates, as well as its own particular sphere of usefulness. Without wishing or intending to disparage any of the various herds of cattle for dairy purposes, I propose to say a few words in defense of the Jersey as a dairy cow. The total amount of milk solids required by law in many of our States is twelve per cent. In some samples of milk analyzed from my own herd of Jersey cows the chemist reported sixteen and seventeen per cent. of solids. The average yield of butter fat, in milk from common cows, was found last year, by our creamery, to be four per cent. In my own herd it will reach over six per cent. In the recorded tests of some of our best Jersey cows it has reached as high as nine and ten per cent., but these cows had been fed and trained for the special purposes of butter production. But it may be said "these are rare exceptions." Let us see. In 1884 Major Campbell Brown, of Tennessee, compiled and published a book containing the recorded tests of Jersey cows that had made fourteen pounds of butter and upwards in seven days. In this volume I find recorded the names and butter yield of four hundred and forty-eight Jersey cows. Of this number twenty-three cows have recorded yields of twenty pounds of butter in seven days, and of this number six cows have recorded yields of twenty-four pounds and over of butter in seven days. The names and butter yields of these cows are worth preserving, and I give them as follows:

1.—Princess Second,	27 lbs. 10 oz. in 7 days
2.—Mary Anne of St Lambert,	27 lbs. 9¼ oz. in 7 days
3.—Nancy Lee,	26 lbs. 8¼ oz. in 7 days
4.—Jersey Belle of Scituate,	25 lbs. 8 oz. in 7 days
5.—Value Second,	25 lbs. 2½ oz. in 7 days
6.—Hazen's Bess,	24 lbs. 11 oz. in 7 days

But this is not all. Major Brown, within the last two years, has col-

lected sufficient material and is now ready to publish his second volume of four or five hundred more Jersey cows having recorded yields, by authorized tests, of fourteen pounds of butter and upwards in seven days. No Jersey cow is admitted in this book unless she will make at least two pounds of butter a day, and we have in these two volumes nearly one thousand cows with such records. When any other breed of cattle can get up such a record as this, then, and not until then, will it be necessary to say anything further in defense of the Jersey cow.

MILK SEPARATION BY CENTRIFUGALS, AND MILK TESTS.

By JOHN I. CARTER, *Chatham, Chester county, Pa.*

I presume intelligent farmers everywhere understand the principles of centrifugal force and its application to the separation of cream from milk by machinery, and probably most of them are familiar with the general construction of the machinery used for this purpose, now called centrifugal cream separators. I shall not, therefore, in this short paper go into any historical account of the various inventions used for this purpose, or of their mechanical construction, or of their introduction to the general public. These phases of the subject have been frequently treated of in papers read before this Board, and it is only necessary to give the present status of these various inventions, of their capabilities and improvements and the practical results of their use in the dairy during the last few years.

Perhaps part of this subject might be left to the manufacturers' circulars, but we know these people are a little given to making rose-colored statements of the construction and work of their own machines and of saying rather disparaging things about the machines of other makers. And you know also there is often quite a difference between the claims put forth in these circulars and the practical work the machines will do when put down to every day use and come under the care of less skilled operators. But we now have had four or five years' experience in the use of these machines and are able to judge pretty accurately of their general usefulness and of the actual capacity of the individual machines and their special advantages.

There are from one hundred to one hundred and fifty creameries in Chester and adjoining counties, almost all of which employ one or more separators of some kind or other, deeming their use economical and essential to the prosperity of the business. These machines will take out of the milk from ten to fifteen per cent. more butter than any other practical method of cream separation; and the convenience and rapidity of the operation is quite an additional advantage. The general quality of the butter has been improved; there is more uniformity in the whole product, and it is easier to fix an equalized standard price for this class of goods.

It is no doubt true that a well-appointed dairy carried on in the old-fashioned way and supplied with milk from well-fed cows might make a better butter than the usual product of our creameries, but it would not be owing to any fault in the manner of separating the cream, but to the fact that the creameries have to use miscellaneous milk, bought once per day, and frequently subjected to quite careless handling by

negligent farmers. Better butter can be made out of such milk as this by centrifugal separators than by any other process, because the cream is got out of it in the quickest possible time, thus avoiding prolonged contamination from the defective milk. The old claim that these machines made a better article of skim milk for cheese and other purposes was perhaps not well taken. It is true that fresh, sweet milk run through a separator will still be sweet, and for a short time palatable, but the thorough aeration or severe treatment it receives in passing through the machines predisposes it to rapid deterioration, and that fact, together with the poverty of the milk from thorough skimming, made the making of a good skim cheese an impossible matter. For drinking purposes the skim milk also soon becomes insipid and unpalatable. Of course, the cream produced by these centrifugals requires different treatment from that raised by the old methods. It must be cooled down quickly and churned in one or two days at most. It also requires a different treatment when used for making ice cream. It must have all the froth taken off of it and be liberally diluted with new milk. By the way, this froth is often considered a great bugbear, but in reality is of little account if you know how to manage it.

All centrifugals make more or less froth, the amount depending more on the temperature and condition of the milk than the style of the machine. In point of fact, there is but little difference in the quality of the work done by the different machines as at present improved, and the prices and capacity of them agree pretty closely. It would be unjust as well as ungracious to recommend one machine above another, as the testimony of the people using them show that some are adapted to one place or circumstance and some to another, and nearly all are equally good.

The following list comprises the kinds of centrifugals in use amongst us, with their capacity for work and the power required to drive them as far as our experience shows:

The twenty-five-inch Danish-Weston costs $500, takes about a four horse-power to drive it, makes 2,000 to 2,400 revolutions per minute, and separates about 1,000 pounds of milk in winter and 1,200 pounds in summer.

The fifteen-inch Danish-Weston costs $325, takes two and a half to three horse-power to drive it, makes 3,500 revolutions per minute, and separates 600 pounds in winter and about 800 pounds in summer.

The Home Danish-Weston costs $250, makes 4,000 revolutions per minute, skims 600 pounds per hour, and takes two horse-power to drive it. This machine is so lately put upon the market that the above figures are taken from the manufacturer's circulars and not from our experience.

The DeLaval costs about $275, takes about a two horse-power, makes 8,000 revolutions per minute, and separates 600 pounds in winter and 700 pounds in summer.

An improvement on these machines increases its cost and its capacity about equally.

The Backstrom separator costs $185, takes one and a half horse-power to drive it, and makes 7,000 revolutions per minute, and separates 400 pounds in winter and 600 pounds in summer. This is also a new machine, and part of these figures are those given by agents.

Any of these machines will require skill and some experience to run them successfully, and the cream and butter they produce will take

more intelligent management than the cream and butter secured in the old fashioned way.

The large Danish-Weston is perhaps the most substanial and reliable machine, but it requires large and heavy foundations, occupies considerable space, and costs a good deal of money. I have running, to day, about the first large separator ever put up in our country, and after five years of constant work is apparently as good as ever. Our moderate sized creameries, however, now prefer to put in two or more small machines of some kind, partly to provide against a total stoppage of work should anything happen to one machine, and partly because they are more manageable as regards space, power and care. In providing a creamery with separators, it is well to have enough to do the work without too much delay. The separation should be finished by ten o'clock A. M. during the hot weather. When forty or fifty lots of mixed milked is dumped into one receiving vat, to stand till separated, it is soon seriously damaged, and will not make good, long-keeping butter.

Perhaps this is all I need say about separators now; any other information needed will be gladly given upon inquiry.

I had proposed in this connection to say something on the testing of milk for butter value, but owing to a disastrous accident to some of our machinery, was not able to complete some experiments and tests that I hoped would be interesting to report. I am sorry to have to say, therefore, that I know of no reliable test for milk quality that is practical enough for every day use in our dairies or at our creameries. The simple tests that have been in common use, such as the cream guage glass, the lactometers, pioscopes and other opacity tests, were too uncertain or too indefinite to accept as a basis to assess value upon. When it comes to paying a captious milkman for his milk according to its supposed value for butter purposes, you must be prepared to make a very clear showing that your figures are all right, if not you will get into infinite trouble, as well as being liable to do injury to others and yourself. The Curtis oil test-churn, now in use in many of our western creameries, looked like a plausible help, but late carefully conducted experiments with it indicate that when used for testing milk the quantity of fat is too small to be accurately measured with the eye or rule.

Probably a chemical analysis by a careful analyst would be the safest test we could make, and as the process is simple, it will not be impracticable to adopt it. It is the simple evaporation of a sample of milk in water-bath ovens, treating the residuum solids to ether to dissolve the fat, and then evaporate the ether. By very delicate scales these remainders can be weighed, and the amount of butter fat accurately determined.

N. F. UNDERWOOD of Wayne. I understood Mr. Carter to state that he found the ordinary or common oil test as applied to milk to be unsatisfactory and unreliable. Does he consider it to be reliable when applied to cream collected by the cream-gathering plan, churn the cream and reduce the butter to oil, is it then reliable?

JOHN I CARTER of Chester. Our churn (for testing samples of milk) is simply a collection of small phials or bottles, perhaps six inches long and five-eighths of an inch in diameter. These are filled half full and then set away and the cream allowed to raise, and then churned. They will only hold a very small quantity of milk, not more than three or four ounces. Now the butter fat in that much

milk must necessarily be very small. The amount of cream is decided by a number of minute lines on the side of the tubes; at best the cream in that amount of milk makes a very thin and indistinct line. When the milk is poor in butter fat of course the line is still more difficult to see and accurately measure by the eye. You cannot tell by the gauge whether it will take nine or ten quarts of milk for one pound of butter. It is a little too fine work to be practical.

Another difficulty with this mode of testing is that butter fat is liable to absorb from five to fifteen per cent. of water, and the amount thus absorbed will depend somewhat upon the character of the cream; consequently we do not find them sufficiently accurate for our purpose.

Question. How does the quality of butter from cream separated by the centrifuge compare with that made in the old way?

John I. Carter. The quality of the butter is not affected; if that made by both processes is equally free from all bad surroundings and odors there should be no difference. Under the old process it was very often the case that the resulting butter was effectually spoiled by the absorption of bad odors while the cream was raising. This was more the fault of the dairyman than of the process. With the centrifuge we, by taking out the cream soon after milking, avoid this danger. As a matter of fact, and taking the average butter as made by the old process of raising the cream in shallow open pans, the centrifuge will make the best and sweetest butter; aside from this there will be no difference. If you take the milk right from the cow and run it through the separator you can readily so take care of the cream that it shall absorb no bad odors, but it is much more difficult to prevent the same trouble with the amount of milk necessary to produce that amount of cream by the old process. In some cases we put the milk through the separator twice each day (morning and evening's milk separately), but once a day is the usual rule, and is ordinarily sufficient if proper care has been taken of the milk after it left the cow and between the milking shed and the creamery. With the separator, as with the shallow system, or the Colley system, all depends upon having good, sweet and pure milk; without this neither will make first-class butter, but from the fact that the milk is exposed to the danger for a much less time, the separator is safest and best.

A gentleman asks an opinion on the "cream gathering plan," by which each patron raises his own cream and it is then sold to the creamery. The plan is open to several objections. The creamery does not control the treatment of the milk so well as it can when the whole milk is taken, and as a conseqence the cream is not as uniform in quality. One batch of bad cream will injure the whole churning from any number of patrons; the farmer has entire control of the milk, and the creamery owner does not know how it is handled. He only gets the cream, and that is by far the most likely to be injured by any bad management or odor. In our neighborhood all of the creameries require that they shall have the whole milk hauled to them within a certain number of hours after it is milked. If the farmer wants the milk we have an arrangement by which he can have the skim milk to haul back. Another trouble is that the cream is more sensitive to injury than the milk, and in hauling it around the country (as in the cream gathering plan) it is much more liable to injury than the whole milk is. From these and other causes the butter from creameries to which the whole milk is hauled should be the best.

Question. What value would you give to whey and skim milk for feeding hogs; will it make them fat?

JOHN I. CARTER. I do not know about making hogs fat on centrifugal milk without some meal with it; we take out all of the cream and there is very little left of fattening value in the milk; it is better for growing stock.

Secretary EDGE. Is it not better to keep more hogs and use some meal, than to feed nothing but the milk? Will you not get better results from the same amount of milk in this way?

JOHN I. CARTER. Certainly, it is best to use some meal; if you feed sweet milk to hogs you must get them fat in about sixty days, or if you feed them much longer they will "break down" and will not do so well. Some farmers take the skim milk home the morning that it is separated and feed it to calves, but they obtain the best results by mixing meal or "shipstuff" with it.

J. P. BARNES of Allentown. With a dairy of from fifteen to twenty cows, would we be warranted in investing in a centrifugal machine for taking out the cream?

JOHN I. CARTER. They are now making hand machines for small dairies, but I do not know with what success; I do not know whether they are practical or not; it does not require much power to separate the cream, but it does require considerable power to maintain the high rate of speed which is absolutely necessary; with a hand machine it would be very difficult to keep the speed regular, and regularity of speed is one of the most essential points in a successful separator; if run too slack all of the cream will not be taken out, and if too fast, some of the milk will go over with the cream.

Question. Can they get sufficient velocity for good work with a hand machine?

JOHN I. CARTER. I should think that they might, but the main difficulty is to obtain the necessary regularity of speed without which the plan will fail; at any rate every dairyman should have a small engine; it is useful to cut fodder and hay and to heat water, &c.; it could readily run a small separator, which might be bought for one hundred and fifty dollars or more, according to size.

Question. Do you know of any reliable mode of testing the milk furnished to creameries by patrons? This matter has given us more trouble than any other; do you know of any reliable plan to overcome the difficulty?

JOHN I. CARTER. I do not; I thought that I was on the right plan when I put each patron's milk in jars, very similar to quart fruit jars and churned twenty samples at the same time and in the same churn, but I found this difficulty—all, the sample jars contained exactly the same amount of each patron's milk; they were all churned by the same operation and at the same temperature; but one sample would give us nice firm and hard butter of an excellent quality, while another would give a product much more soft and oily and not at all satisfactory; in some cases the sample would give up its buttermilk and water and work out clean; in others it was impossible to separate the water and buttermilk fairly; and this spoiled the test, for we could not obtain the weight of the milk and water which was necessarily left in the sample.

JOHN HOFFA of Northumberland. My experience in keeping a small dairy of from fifteen to twenty cows is that I can get the best results from my skim milk by feeding it all to my chickens; I put it in a

barrel and when it is thick I feed it to my poultry; the whey or thin part I take off and feed to the hogs.

EASTBURN REEDER of Bucks. It is very well to know how to make good butter, but there is another point upon which we want some information, and that is how to dispose of it to the best advantage. We cannot all get the high prices which Mr. Darlington of Delaware county gets, nor which Mr. Ball of your county gets. What is the best plan for shipping butter for long distances? What kind of vessels do they ship it in?

R. S. SEARLE, of Susquehanna. I have been shipping butter to New Castle each week during the summer; the box is large enough to hold the butter and enough ice to keep it for twelve hours; the box is however too heavy and my brother is making some lighter and lined with tin.

Secretary EDGE. At the Farmers' Institute, held here last week, the profit of shipping the skim milk to the cities for the manufacture of "German hand cheese" was discussed; can Mr. Carter tell us anything of the plan and its profits?

John I. CARTER. Some few in our county ship their skim milk in this way: The whey is taken out and only the curd sent; it is shipped in strong barrels well covered with stout canvas.

E. BRINTON of Chester county. I know of but one firm in Philadelphia who make this kind of cheese; the demand for curd for this purpose is very limited; the prices of making German hand cheese is patented in this country and but few are making the goods. I formerly shipped large amounts of my skim milk in this shape; at first they paid two cents per pound for it; the freight was about one-quarter of one cent and this left me about one and three-quarter cents, which paid very well; but competition soon brought down prices so that it did not pay and I abandoned it entirely.

Mr. CAMP of Susquehanna. During a recent visit to the dairy of Mr. Wells, I noticed that he uses pails covered with a composition which he styled "rubber composition;" it is of a dark brown color but does not injure the butter in any way he tells me. There is a wooden cover with means for fastening it on.

Question. How much will the pails hold?

Mr. CAMP. The ones that I saw held from thirty to forty pounds, but they may be of any desired size; I alluded more particularly to the use of the water-proof composition.

OUR EXPERIENCE IN PRACTICAL DAIRYING.

By E. G. & C. P. BALL, *Montrose, Pa.*

Feeling that if our experiences would stimulate other farmers to improve their dairies, either in the line we have followed or some other, we would cheerfully give it, we have consented to write a plain statement of facts, and if there are any present that have heard any of these facts before, they will please bear in mind that as facts cannot be changed it will be necessary for us to repeat some of them.

First, we have no thoroughbred stock to sell. Second, we have no feed to sell. Third, we have more orders for butter than we can fill, consequently we have no axe to grind. We have had no experience

in the manufacture of cheese; our efforts have been directed to the improvements of our herd and the quality of butter. In the year 1877, we purchased a Jersey bull to cross with our native stock for dairy purposes—we suppose the term native my be used properly, as there was not much, if any, foreign blood in them. Since that time, the year 1877, we have used males of that breed, endeavoring to purchase such as would give us stock that would increase the yield in butter, never purchasing an animal unless his dam had a good butter record; although we have purchased animals without such record, that were fine looking, for less money. We have never paid what we considered an extravagant price, and never sought for stock from cows that had been forced to yield six hundred or more pounds per annum; although we might have been tempted to do this if we had been favored with more money.

Allowing our heifers to come at two years of age, we never used the same male but two years, believing that the in-breeding has a tendency to weaken stock. We occasionally set each cow's milk separate, churning and carefully weighing the product, at the same time taking into consideration the age of the different animals, as well as the time they had been in milk, in order to determine which should be sold, and from which to raise heifers for our own use.

We are often asked if we think grades as good as thoroughbreds for butter; having never milked thoroughbreds we do not know. We are asked if we think Jerseys are the best butter cows. We answer that we know that they are better than the natives we commenced to cross with. We have no practical knowledge of any other breed as butter makers. Our action shows our belief. In caring for them we think kind treatment pays, believing that a kick or blow, or even a sharp word may cause quite a shrinkage of milk at the time, some nervous animals suffering more than others. In feeding we intend to give them all they will eat, generally using fodder corn after the supply of grass becomes short, cutting it from the root and allowing it to wilt before feeding, thereby avoiding liability of having grainless salve instead of fine granular butter. In the winter of 1884, we commenced cutting and steaming the coarse fodder, using a power cutter run with a one-horse tread power, and we are satisfied that it pays well for the extra labor and expense. During the time the cows are dry, say from the first of January to the fifteenth of March (dates liable to vary of course), we feed about two and one-half pounds of grain per day. From the time they come in milk to about the first of June, six pounds. From June first to August first about two pounds, and from August first to January first, about three pounds per day. If any one thinks that the small amount of grain fed between the first of June and the first of August is a waste of feed, we can assure them that it is not. We get it back in different ways; not only in a larger yield and better quality, but in the satisfaction of seeing the cows quietly take their places in the milking shed; and here we desire to say, that no farmer would ever milk in an open yard after using a shed. No matter how hard it rains, the milking goes on, and then it is milk instead of a mixture of milk and dirty water in pails.

We do not think it correct to charge all the grain fed to the butter alone. A portion should be charged to the improved quality of the manure (with most kinds of grain), more to the coarse fodder saved.

The cash value of grain fed to each cow in any one year has never exceeded fifteen dollars. We feed the various grains raised on the

farm, the principal feed being wheat-bran and cornmeal. We never feed roots, not that we are prejudiced against them, but they cost us too much for the value in them. The milk is set in large shallow pans, each pan holding one milking, and is cooled to the proper temperature for raising cream in them as soon as possible by running ice water around them. The cream is taken from the milk twenty-four to forty-eight hours after setting; we use a Stoddard churn propelled by horse power, which is stopped as soon as the butter is shown upon the glass in the cover in granules the size of a kernel of wheat. The buttermilk being drawn from the churn a pail of cold water is thrown in, and being agitated is drawn, repeating the same until the milk is all removed from among the granules of butter, when it is taken from the churn, in the granular form (a low temperature being required to keep it in that form), to the balance where the proper amount of salt is ascertained. The balance is so constructed that it can be adjusted for salting butter for different markets or tastes. For our own use, for Scranton, Wilkes-Barre, Mauch Chunk, Bethlehem and New York, we use one ounce of salt to the pound, while Philadelphia and some individual customers want but three-fourths of an ounce. For several months past we have used one ounce of salt, not caring to go to the trouble of salting small quantities separate for those who ask for light salting, while there is a demand for all we can make uniformly salted. After ascertaining the proper amount of salt the butter is placed in a butter worker and salted with salt made by the Warsaw Salt Company, at Warsaw, New York, working it as little as possible and get the salt evenly distributed through it. After standing a few hours, it is again worked, but not enough to destroy the grain; when it is printed or packed, as the case may be, for market. The prints are wrapped in parchment or paraffine paper, laid on trays in shipping cases holding from twenty to fifty-six pounds. In warm weather we place a metal box filled with ice in the case when it is shipped. We pack some in small pails lined with paraffine (known as the Bradley package). They are of different sizes, ranging from one-half pound to ten pounds each, are very light, and are shipped in crates holding from forty-eight to sixty pounds. They are very convenient for the retail grocer, and are growing in favor. Of course there are many details in the manufacture of good butter that it is hardly possible to put on paper or even tell, as only practice and care of all little details at the proper time, and at all times, can give one a full knowledge of how it is done. I have said nothing of the extreme cleanliness necessary, as all butter makers are supposed to be neat. Our efforts to improve the dairy up to January 1, 1886, had raised the average yield of butter (not including that used by two families and hired help) from one hundred and twenty-five pounds per cow to two hundred and thirty-eight and seven-sixteenths pounds in the year 1885. We think that the quantity is steadily increasing, but cannot give exact figures for the year 1886, as we bought some cows in order to keep up a supply of butter in the winter, which we find necessary in order to hold our customers at fair prices. At present we are unable to fill all orders received.

BREEDING AND RAISING CALVES FOR THE DAIRY.

By EZRA MICHINER, *Carversville, Bucks county, Pa.*

This sbbject has been written about and discussed until it would seem that all had been said that could, in any manner, enlighten the dairy farmer in his endeavors to keep up to the times in his calling.

A proper consideration requires that we should study the different breeds of cattle intelligently, that we may be able to decide which we will adopt, as I claim it to be an absolute necessity that to breed and raise a profitable dairy, and keep it supplied for a lifetime, some one of the distinct breeds of cattle must be selected. It is true that there are many valuable dairy cows among the common stock of the country, but they have been bred in such a haphazard way for generations that no reliability can be placed upon them to duplicate themselves, and if you cannot have a reasonable assurance of what you are going to breed when mating animals, you cannot obtain a first-class dairy of fifteen to twenty cows in a lifetime.

Therefore, the dairyman who does not raise his own stock must buy the common cows which may be for sale in his vicinity, as the thorough-bred ones are too high in price to purchase merely for their milk-giving qualities.

Our subject, however, does not reach this class, and we must presume that all are to raise their own cows.

The surroundings of different persons are such that the breed which would exactly suit in some localities would be entirely unfit in others.

The way the creameries are managed in Bucks county, it would appear to be a good policy for each patron to raise cows that would give a large quantity of milk, without regard to the quality. A difficulty is met here by the fact that if all dairymen had the large milkers, whose milk was deficient in butter, that the price paid at the creamery would be less per hundred weight, and the receipts not amount to as much as they now do. While a few who have cows of the Jersey or Guernsey breeds patronize the creameries, they do so with the full knowledge that they are not getting value received for product, and are benefiting their neighbors more than themselves.

In the western States they are ahead of us in this particular, and buy their cream at a price per inch, governed by the amount of butter each patron's cream will make by repeated tests.

To get at our question fairly, I will state that, when I was invited to prepare an article for this meeting, it was stated that the best breeds of cattle would very properly be considered a legitimate branch.

I will, therefore, state my preference by saying that I think the Guernsey is the best cow to raise for the average dairyman in this section, whether he intends to manufacture his butter at home or take his milk to the creamery.

I do not claim, as some breeders do, that my choice is a perfect general-purpose cow—that is, a perfect milk cow, and a perfect beef animal in one—a combination of two qualities as essentially different as to combine a race horse with a draft horse and expect the combination to be equal to either pure bloods to a heavy load or on the track.

We very frequently hear the remark that our cows are too small to be profitably fattened and sold to the butcher when done milking,

and, consequently, a great loss must result. This idea is as preposterous as it would be for the housewife to buy a stove about three sizes larger than was necessary to do her cooking properly, and that would consume one-third more fuel than the smaller one, merely for the sake of selling it for old iron when no longer useful. The beef which now comes from the West has driven our farmers out of the business of fattening old cows that will always cost more than they come to, whether a diminutive little Kerry, or the massive Hereford, or Durham, provided they have spent a dozen or more years in profitable milk-giving.

The Guernsey cow is a cow of fair size, averaging fully one thousand pounds at maturity, and possessing a good constitution, and no more liable to disease of any kind than the native cattle. They will make as much butter in a week or year as any other breed of cattle in existence, and make it richer. Their milk and butter is higher colored than any other race of cattle. No coloring material or oleomargarine oil need ever be used, even in winter, to color their butter.

Their own color shows this, even to an inexperienced person, as they look like butter, being generally of a rich, golden, yellow fawn. They are very quiet in disposition, and become much attached to their herdsman.

The bulls are less apt to become cross than many other breeds, and can be profitably kept as long as wished.

Having chosen our breed, we now start to improve upon it if possible. The first selection has much to do with our future success or failure, as both are possible with any breed. It is a saying among breeders generally that the bull is half the herd, and my experience confirms this statement. I had the choice of two bull calves when I first started breeding, and chose the inferior one, on my poor judgment, at the same price. When I made my selection known I was promptly refused the calf, the owner saying that he was not worth raising, and that he should be killed on the premises. The other one he said would make about a perfect animal, and would perpetuate his good qualities in his offspring, a statement which proved to be correct. I would, therefore, advise all young beginners to take cousel of trustworthy persons before beginning, as they will gain by so doing a great amount of useful information.

In selecting a bull I am firm in the belief that quality is the first essential point to be looked after. You can breed and feed for quantity, but the quality is harder to obtain, and when once established requires constant watching that it does not deteriorate. I have made my selections of bulls on this plan, and feel that I have been highly successful in every one purchased.

It is not necessary to pay fabulous prices for stock to commence with, as good cattle can always be bought at reasonable figures.

Having selected the bull the next point is to get suitable females for mating with him. What I mean by suitable is that they should correspond in general makeup and constitution, as near as possible, as a greater uniformity of their progeny will be the result if this plan is carried out.

Our calves are now ready for the making of our future cows, and perhaps the greatest difficulty we have to encounter stares us in the face, as I believe the first six months of the calf's existence is the most critical time of its life as regards its future usefulness. They should be taken from the cow at about a week old and well fed on

food adapted to make a healthy growth without making it too fat, or to reach the other extreme and become poor. The calf is very apt to be neglected in a busy time, and not fed at regular intervals, and the consequence is that when fed it eats too much and too hurriedly, and indigestion follows with its many evils, and the calf suffers from this want more in one day than can be repaired in a week.

An article in a recent copy in of the *American Dairyman* suits the case so well that I take the liberty of using it here:

"We would advise that you now give the calves a severe overhauling to see what condition they will be in when cold weather reaches them. Are they plump enough to make a good stand against a sleeting nor'-wester, or will they, on account of being in thin flesh, need a great deal of coddling to get them through the winter so that they will come out in the spring spry and ready to take grass and push ahead without the delay of needing to be rebuilt in order to reach the point they were at in the fall. Of course we are not advocating a plan of fattening calves so that they can stand any kind of weather and needless exposure. We believe in good, warm, dry stables; but we know full well that few farmers have such things for the use of calves and the other young stock of the farm. Such critters are usually left to shift for themselves, while the cows in milk, and especially the horses that, being old and tough, could stand bad weather better than any of them, have the warmest corner of the stable, and not only the deepest but the only bedding of any animal on the farm. No one can complain of favors shown the cows in milk, for they are generally thin of flesh and highly sensitive to cold, but the young stock of the farm, though they may look in good condition and be comparatively fat, yet their flesh is tender and their hair and hides are comparatively thin, making them feel the effect of raw, cold weather to a very trying degree. It is easy enough to confine such stock in a large dry room to themselves where they can keep warm and comfortable; such treatment is not only human, but there is money it."

Of course the calves should have regular exercise, and not be confined to the stable at all times, but be out every fair day in winter, in a sheltered yard, as their appetites will be keener and their digestion better for this diversion.

If kept in this manner they should be allowed to come in profit at about two years of age, so as to have the milking habit early established in their lifetime. If they are allowed to go much beyond this period before becoming cows they will probably take on too much flesh, if well fed, as they should be, and this is a point to be guarded against, as the flesh forming habit once formed in their early life becomes a second nature, which will take years to overcome.

There is no use of any man attempting to raise a herd of dairy cows unless he has a natural aptitude for the business, and will give it a fair share of personal supervision, as raising good cows by proxy is not very often successfully accomplihsed.

OUR CREAMERIES—THEIR USES AND NEEDS.

By JOSEPH ROBERTS, *Solebury, Bucks county, Pa.*

Having been requested to prepare an article on creameries, I have made an effort to present to you a few thoughts, experiments and

facts relating to this subject. Trusting you will pardon all inefficiency, and that in expressing my honest convictions, I will call forth free and earnest comments from those who differ in opinion. Prejudice and ignorance are two enemies that must be overthrown.

Though only five years have elapsed since the introduction of creameries into Eastern Pennsylvania, some twenty establishments have failed, and many others are not doing a profitable business. On the other hand, several factories have been remarkably prosperous and show a striking contrast when compared with their unfortunate neighbors.

The increasing demand for creamery products show that in many instances the factory process is growing in popular favor. The introduction of separators, by which ten per cent. more butter can be made than by the ordinary process, has placed our creameries on a firm basis. The excellent quality of this butter insures its future use. In comparing the value of creamery with average dairy butter, we find the advance in price in favor of creamery butter to be about four cents a pound. This, at the rate of four pounds to the hundred weight of milk, yields a gain of twenty cents. A factory receiving five thousand pounds of milk daily will pay more than all expenses connected with its operation.

In speaking of dairy butter I have taken the price paid by the stores, and in neighborhoods where the creameries are not so located as to make it convenient for the farmers to sell their milk. Of course there are many dairies that exceed the creamery in price of butter, but they have always been in advance of the average farmer, and generally market their own product.

The quality of creamery butter may still be improved, and the low prices received during a part of the year avoided by a little different management and arrangement. Many of our creameries have not proper facilities for ripening their cream. They should have a place where the temperature is the same as they desire to churn, without using ice-coolers. Each creamery needs a place in its ice house, or better still, a separate building may be provided by several creameries joining together, where the butter made during the very low price in summer can be stored away, thus relieving the market from so much surplus butter which may be sold to an advantage in the fall or winter.

I do not think that the creameries in this section have advanced as carefully and thoroughly as they should in some things. I am sorry to say that there are creameries that are noticed more on account of their uncleanly condition than any other one feature they possess.

This state of things is to be deplored, as it reacts upon the whole creamery system, and has great influence with our best customers, beside giving us the reputation of not being calculated to produce the most desirable grade of butter. Men, as a rule, are not as neat and clean as women, and do not take pride in scrubbing and scalding. Consequently, creameries operated by men not adapted to the business fail greatly in this respect.

A spirit of strife and competition is a stimulant, and in many ways has a good influence; but genuine coöperation among the factories will aid vastly more in their improvement. I regret, exceedingly, the apparent indifference of the managers and their operators in making an effort to attend meetings expressly designed to promote their welfare. Any enterprise, springing into existence so rapidly as the creamery system has done, must require time to correct the many errors

that have been made by persons not familiar with the business. I presume that the majority of the creameries were planned and finished by those who know but little about the real requirements of dairy factories.

In many instances costly buildings and improper and expensive machinery have contracted a debt so large that though the persons interested were competent business men, they found the expense greater than the profit.

Another cause of non-success or failure is traceable to dissatisfaction among the board of managers, this diversity of opinion and inharmonious action of the persons empowered to conduct the business resulting in discontent among the patrons and indifference with the operators, who feel that no matter what they do there will be fault found with their labors. Still another source of trouble arises from employing persons not calculated to properly run a creamery. We need more live men to work for the furtherance of our own creamery interest in all its departments. We need greater care in manufacture of our butter.

We need to learn different methods for the making of skim milk into some good and wholesome article of food to take the place of these hard skims, that are a drug on the market most of the year. We know so little of the manufacture of the variety of cheeses made in the old country. There are various kinds of soft cheeses that could undoubtedly be made and sold to advantage in our cities.

I do not think there has been sufficient importance given to the testing of milk to determine the real value of the different dairies. Having made several such tests, I am well aware of the extra labor that these experiments require. In using the butyrometer, the cost of chemicals is also a drawback, as well as the knowledge of the strength of materials.

Being informed that some of our creameries have decided to pay for milk according to lactometer and cream gauge tests, I desire to mention a few facts that I have gleaned. It has been clearly proven and decided in several cases brought before court that the lactometer, so extensively used by our creamery and factory men, is not accurate, and cannot be relied upon as determining the purity or richness of milk. The Frankford cheese factory, of Herkimer county, New York, brought suit against one of its patrons for the adulteration of his milk. The case was considered a very important one, and intense interest was manifested by factory men and others. The trial lasted two days, and eminent counsel was employed on both sides. The decision was rendered in favor of the defendant, it being proven that the lactometer will show a variation of ten degrees to pure milk taken from the same breed of cows while being fed on the same kind of food. Professor Volker, in making four tests of pure milk, found a variation of 16.10 degrees, as recorded by the lactometer.

Our creamery men will find it important to investigate the cream-gauge and ascertain if it be any more reliable than the lactometer. Now, that which at first seems clear becomes doubtful, and further search proves fallacious, as fifteen per cent. of some cream will produce less butter than ten per cent. of others. A creamery in Illinois in testing thirty-six patrons' cream by the "Fairlamb cans, that should yield one pound of butter to an inch of cream," found a variation of eight to twenty-four ounces of butter from an inch of cream.

L. H. Harding shows in his writings that it is impossible to deter-

mine the true value of milk by any cream-gauging system. There are so many things to be taken into consideration—the time of year, the food, the breed, etc., and, not least, the care exercised in making the test.

It is well known that if milk is allowed to stand, and the cream is once separated, that the second attempt will not show as large a per cent. This is especially true with Jerseys, or such cows as yield milk in which the globules of butter fat are large. It is equally true with milk that has not been properly cared for. Here lies the difficulty with creameries receiving milk but once a day.

Thoroughly chilled milk, or milk from which the cream has once separated, or milk that has been allowed to get almost sour will not show a large per cent. of cream. Yet the butter is there, and by churning the whole milk may yield more butter than milk differently managed and showing a greater per cent. of cream. Thus, milk showing only ten per cent. of cream may produce more butter than milk showing fifteen per cent.

Shall we then churn our milk in small samples as the correct test? This method is said to be successfully practiced in some parts of the West, and has been adopted by some of our best dairymen. In this test, also, there must be great care exercised, as it has been shown that new milk may not yield one-half of its butter, as appears in the following test:

One hundred pounds of new milk yields one and one-half pounds of butter. This milk churned the next day one and five-eighths pounds of butter; churned again on the following day, nearly one pound more. Several experiments made gave similar results, the temperature in churning being sixty-four degrees.

All milk tests are considered by many persons to be unsatisfactory and useless. This belief retards progress in improving the quality of milk, and encourages among managers and operators an indifference that I consider akin to failure.

If the coöperative creamery system is to be a greater success in the future, the managers of the various factories must meet together to compare their views on the dairy and kindred subjects; to make their cause more popular in State affairs, and see to it that they are properly protected by law. They must not permit a few earnest people to do all the work. A more united action is absolutely necessary in this direction, and it is through farmers' meetings and conventions that much good can be accomplished. The laws that have been passed in our favor must be watched and enforced, or we will lose our vantage ground. Let us put more enthusiasm into our work. Farmers should take more interest in their creameries, which not only add to their profits, but remove a heavy burden from their wives and daughters.

THE CREAMERY SYSTEM OF EASTERN PENNSYLVANIA.

By E. BRINTON, *West Chester, Pa.*

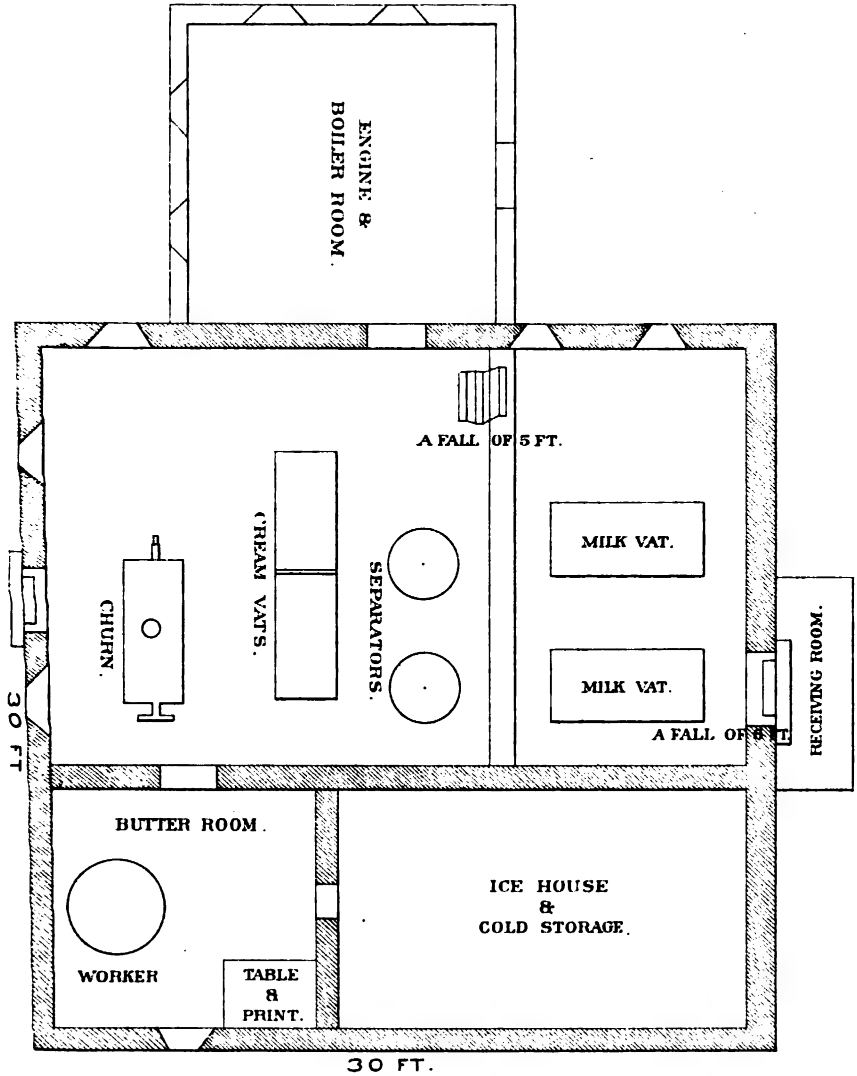
[Read at Montrose meeting.]

The object of this article is to state in a concise and practical manner the workings of creameries in eastern, or perhaps more particularly south-eastern, Pennsylvania. We do this with a degree of con-

fidence, as the creamery system in the section alluded to has been universally successful. Its growth only extends over a period of perhaps ten years, yet the decided success of the system from the start has insured a steady and rapid growth until it has largely supplanted individual butter dairying. A careful inquiry among a large number of creamery patrons of Chester and Delaware counties developed this fact. A dairy of common stock cows carefully selected and well cared for will earn for the owner from seventy to eighty dollars per head every year for milk sold. One of two modes is used in operating a creamery: First, that of individual ownership, where the milk is bought outright from the farmer by the proprietor, and second, where the creamery is owned and operated by a number of dairy farmers who have formed themselves into a stock company, very frequently having the corporation chartered, each farmer furnishing capital in proportion to the size of his dairy, say five dollars per cow. Stock is issued to him to the amount he subscribed. So the creamery is owned and controlled by those most interested in its success. A board of directors is chosen from the stockholders, who directly manage the concern. A competent butter and cheese maker is employed as superintendent at the creamery. At the end of each month the directors take account of all receipts and after deducting expenses divide the amount remaining among the patrons *pro ratio* to the milk furnished. Both of these operating plans have met with success generally. Yet it appears that the creamery system is gradually drifting into the hands of individuals. When creameries were new and experimental, as it were, individual capital was slow in taking hold, but since the farmers, by their marked approval have assured the success and permanency of the system, competent parties with plenty of capital have not only been willing but anxious to undertake the business, and as they generally have returned to the farmers for their milk fully as much as they realized by the coöperative plan, the farmers have been more than willing to let them assume the care and responsibility of the enterprise, and their introduction into every neighborhood has caused an honest competition to spring up, so that the farmer need not fear a monopoly against his interests.

It would perhaps be well to next consider the manner of operating creameries. Here opinions, and consequently proceedings, differ very much. Some manufacture butter or cheese only; others both. In some cream separators are used, while others use cooling vats to separate the cream from the milk. Again, another is the cream gathering plan. Where the last plan is adopted, of course, only butter is made. A factory is built in the center of a dairy district, cans for raising cream are distributed among the farmers and the cream hauled to the factory every day or every second day. This, of course, is done by the creamery operator, and one team is enabled to cover a large district. There are several patterns of cans to raise the cream, but in the main they are much alike, and consist of a can about seventeen inches deep and from seven to nine inches in diameter, with a graduated glass near the top to indicate the amount of cream that raises. The farmers are paid so much per inch of cream and keep the skimmed milk. One of the three following plans is used by the farmers:

First. It is measured on the setter can by the cream collector, who also skims the milk. A gauge placed in the inside of the can, at the top, indicates the number of inches, and two inches of cream are supposed to make a pound of butter. In some cases the cream is meas-



GROUND PLAN OF A BUTTER CREAMERY.

For from 600 to 800 cows.

The above is a simple but practical plan for a butter creamery for from 600 to 800 cows; it will be noticed that the plan covers but 960 square feet of ground; the engine room may be a simple frame "lean too"; the second story may be constructed to suit the wants of the manager; the plan is intended to be such as will convey the skimmed milk directly from the separators to tanks outside of the building, where it may be used for hogs or calves.

ured in the can and skimmed alternately, one day by the cream collector and the next by the patron.

Second. The farmers are allowed to skim the milk, and the cream is kept in a can bearing a gauge from the bottom upwards, in which it can be measured later by the collector. In this case the skimming must be done eight or ten hours before the arrival of the gatherer, in order to allow that portion of the skim milk which is necessarily mixed with the cream to separate again and settle at the bottom of the can.

Third. The milk is skimmed by the farmers, and the cream is kept in any can in cold water. It is measured in a special pail with a steel rule by the collector. This method does away with all gauges, either in the setting or cream cans. But it can only be used in connection with the test churn. In this case the proceeds of the factory are divided according to the butter value of the cream.

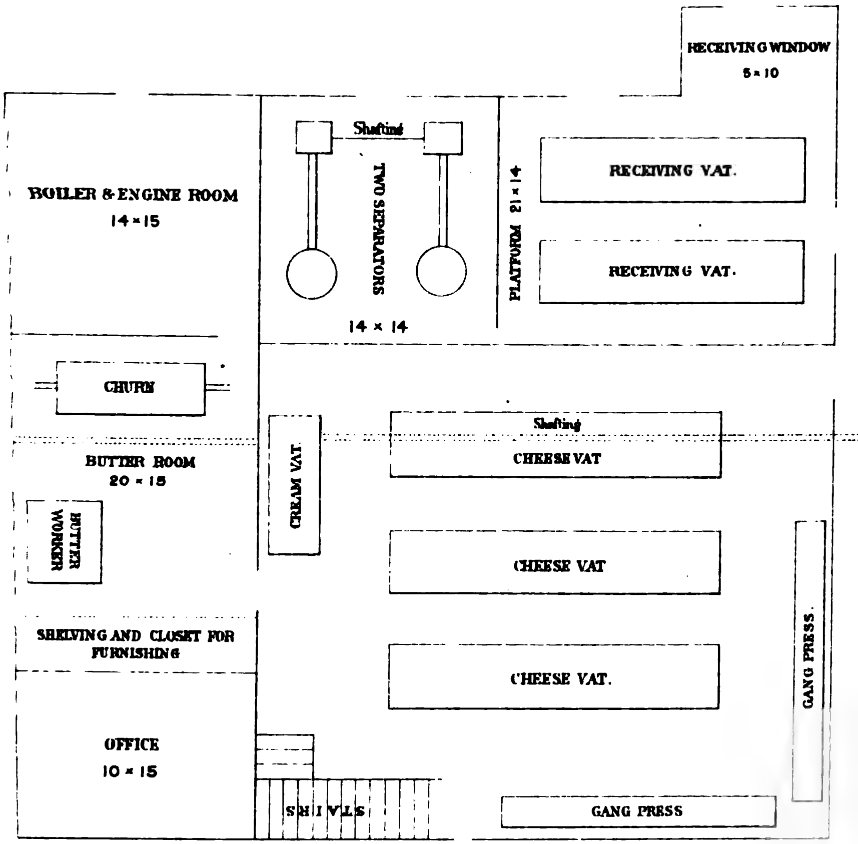
This system, like all others, has its advantages and disadvantages. The expense of building and furnishing a factory where no milk is received is, of course, much less than the other plans. The farmer also is saved the expense of drawing the milk to the creamery, and has besides the skimmed milk left at home; but on the other hand, where the cream is raised and cared for by so many different parties with different surroundings, then hauled a number of miles to the factory, the chances for first-class butter are much lessened, and experience has shows that the per cent. of butter made from the milk is less than by any other system. Where butter and cheese are both made vats are mostly used to separate the cream and milk, as it seems pretty clearly established that separator skim milk makes an article of cheese that has little or no market value. The milk is brought by the farmers to the creamery every morning, weighed and run into the vats, where its temperature is quickly lowered to about fifty degrees by circulating ice water through and about it. After remaining in these vats from five to ten hours, according to the quality of cheese desired, the milk is run off to the cheese vats and the cream to its tank. But the practice of combining the manufacture of butter and cheese in one factory has been almost abandoned in this section of Pennsylvania. Skimmed-milk cheese at its best is an uncertain compound, and often made at a loss. Experience has also shown that this State is not designed to become a cheese-making district, but is devoting its attention to the manufacture of butter, for which its reputation is unequaled; so this article is devoted almost exclusively to the butter factory. It would seem that we can now confidently state that the centrifugal cream separator is a success. It is undoubtedly labor saving, and by its use a greater amount of butter is produced from the milk than by any other process. It is now no uncommon occurrence for the factories to average for months a production of four and one-half pounds of butter from one hundred pounds of milk, while by any other process four pounds was a high yield.

It is claimed by many that butter made from the separator cream is equal to any made, while others are equally certain it is more inclined to be soft and sticky, and will not keep as long. While this will probably continue to be an open question, we must remember the introduction of the separator revolutionized the process of butter making, and we had it to learn over again, and perhaps we are far from perfection yet. Where separators are used, the milk is received each morning from the farmers, weighed or measured, and run into the receiving vats; from them fed into the separators. Great care must be

taken that the milk is the right temperature when separated—75° Fahrenheit seems to be about right. In summer the farmers must cool it to that temperature before bringing it to the creamery. In winter it is necessary to run it through a steam heater, which is placed between the receiving vat and separator. The cream is run from the machines to vats, where it must be immediately cooled to at least 55°, and not churned until it has acquired a slight acidity. But we will go further into the details of handling the cream and making butter farther on. The skimmed milk can be run directly from the machine to the skimmed milk wells or tanks, outside of the building, where it is either taken back by the patrons or fed to hogs or calves by the operator. It will be noticed by this plan, where the new milk is run directly through the separators and out of the factories, much expense is saved in building and fixtures. A plan has been adopted by some operators, who, wishing to do a larger business than the immediate neighborhood would afford, started separators at accessible points and had the cream only delivered at their factories either by rail or teams. In some cases these feeders have been established at mills where the power was obtained very cheaply. The success of a creamery depends very much upon its proper construction, and the first great point to be settled is the location. Of course, it must be centrally situated as to its patrons, and the question of getting the products to market is important; but the matter of a water supply and good drainage are of the greatest importance. There should always be falling ground for a considerable distance from the factory, for waste water, &c., from such an establishment is of the most offensive nature when allowed to stand and become stagnant. Another great advantage of a creamery on an easy hillside is the opportunity it affords to unload the milk at the upper side of the building at an elevation that will give it fall to vats, separators, &c. The question of a water suppiy cannot be too carefully considered. Of course, a natural flow of spring water through the building cannot be improved upon. If that cannot be had, then a well must be resorted to, and water pumped by steam through the building. In either case it must be seen that there is plenty of good, cold water, and no other kind used. Of what material the building is built depends largely upon surrounding circumstances; but let that be what it may, the outside walls should be of a thickness and quality to effectually resist heat and cold, and the question of ventilation is an important one. One of the very best materials for the ground floor is slate slat, one and one-quarter inches thick, laid in cement. The slate absorbs no grease and is easily kept clean. Yet cemented floors, being cheaper, are generally used. A place for the storage of a large quantity of ice seems always necessary, and where it is a part of the creamery proper the butter and storage room are built in such close proximity to the ice as to lower their temperature during the heated months. We know of one creamery in this section where the temperature in the butter room—which is ten by twenty feet—never is above 56° during the hottest weather. This room was built by a refrigerator company at a cost of about $800, and it takes nearly two tons of ice per week, yet it is the most complete and satisfactory arrangement we ever saw.

Estimate of butter creamery and outfit for from 500 to 800 cows:

Building (only proximate; depends much on surroundings),	$3,000
Two large or three small separators,	1,100
Twelve horse-power boiler, ten horse-power engine,	550
One receiving vat (3,500 pounds),	50
Two cream vats,	100



GROUND PLAN OF A CREAMERY

For 600 to 800 cows.

The second floor to be divided into Curing Room, 44×35 feet and into rooms for family of the manager.

One 300-gallon churn,	$0 50
Power butter worker,	50
Butter boxes (if butter is printed),	100
Automatic butter printer,	20
Scales and weighing can,	40
Centrifugal milk tester,	60
Shafting and milk conductors,	50
Milkheater,	15
Miscellaneous expenses,	100
	$5,285

The above statement is, perhaps, nearly correct, though it may vary in many minor matters. If the manufacture of cheese is to be added, the expense of starting would be increased by the addition of two cheese vats, costing $120; two gang presses, $90; sufficient bandaging hoops, $200, and miscellaneous articles amounting to perhaps $50.

Creamery Fixtures.

The great growth of the creamery system of manufacturing dairy products has put the inventive genius of man to work to devise and perfect implements, not only that these products should be of a first-class quality, but that the labor of producing them shall be lessened to the smallest amount possible, and hence the cost to the consumer of the manufactured goods be as low, if not lower than the individual dairy farmer can offer them.

To undertake a detailed description and criticism of these various impliments or fixtures would fill a volume as large as this report. To recommend what we thought the best would seem almost a waste of time and space, as many successful and practical creamery operators would differ widely from us, and parties wishing to furnish a creamery would still have to use their own judgment. Suffice it to say in this article that persons wishing to start the creamery business should deal only with established and reliable houses, and to thoroughly investigate the various patents, buying nothing but the very best if they know it, regardless of first cost, remembering in this as in every other business, the best is always the cheapest in the long run. We have limited our description of creamery appliances to the cream separators and milk testers, as these are decidedly of the first and greater interest to any one wishing to engage in the manufacture of butter.

Making the Butter.

The successful manufacture of first-class creamery butter is almost a trade of its own, and requires years of practice to be a thorough expert. Rules can be laid down to govern the operation, from the time the milk is received until the butter is shipped, but here circumstances alter cases very materially; sudden changes in temperature of the weather, bad condition of the milk received, and many other unexpected and unavoidable casualities occur, and nothing but skill and experience can meet and successfully overcome them. Farmers should be required to deliver their milk at the creamery at a temperature never above seventy degrees. The habit of bringing morning's milk with the animal heat in it and night's milk cold, then pouring both into one vat is a serious mistake. Have morning's milk cooled before starting to the creamery. Of course in winter time the milk will often become too cold to be run through the separator when it is received, but it is now the universal habit of running the milk through a steam heater in its transit from the receiving vat to the separators, and

separate it at a temperature of about seventy-five degrees, but the cooler it is kept in the receiving vat until separated the better condition the cream will be in. The cream should be rapidly cooled as it flows from the machines down to at least fifty-five degrees; spring water will do this, but ice water is still better; it should be kept at this temperature until churned. It is a mistake, undoubtedly, to churn separator or any other kind of cream sweet, it should always acquire a slight acidity, as it will generally do by holding it over one day, if it does not naturally do so a sufficient amount of sour cream should be mixed with it after being separated. Care should be taken to stir the cream frequently until churned. Churn at a temperature not above fifty-eight, and no matter what the pattern of churn is, the agitation of the cream must be regular and not fast enough to bring the butter in an oily and sticky condition. When the butter, in churning, has gathered to about the size of small fish eggs, it is well, especially in summer, to pour in the churn a lot of ice water, then continue churning a few minutes only, then every drop of buttermilk will be drawn off that can be, then work the butter through two waters by throwing cold water in the churn and letting it make a few revolutions. Lift the butter out of the last water and take it to the worker. Nothing connected with butter making is of more importance than the churning, a few revolutions too many of the churn materially hurts the grain of the butter; the temperature of the cream is also of vast importance. So he who wishes to be an expert in this business can not give too much study to this part of it. When the butter is removed to the worker it is then salted and the salt worked through it. After the operator finds the amount of salt his particular trade demands he should always have it just right by weighing both butter and salt. After the butter is salted put it away in the lump where the temperature is not above sixty degrees, until the next day, when the salt will be thoroughly dissolved, the butter firm, and it can be then well worked, sponged and printed or packed, without becoming soft; if printed the cloths should be put on the prints as taken off the printer to insure a good shape and neat appearance when offered to the customer, for every operator will discover that the neat, attractive appearance of his goods will be a power in successfully disposing of them. And now, just one word to the milk producing farmer. The creamery system seems to be where all butter dairying is drifting to, to make it succeed best, not only to the operator but to you, you must make the operator's interest yours, in producing the very best and purest milk you can, in conforming to such rules in delivering your milk as are necessary for the making of first-class butter—to feed and care for your cows the same as though you yourself would make the butter and market it, and in every way possible make the creamery you patronize a success, for of course the better it succeeds the more satisfactory returns.

A HIGHER STANDARD IN DAIRYING.

By M. W. OLIVER, *Member from Crawford county.*

I once read of an artist who conceived the idea to execute upon marble a bust representing the Great Teacher. Month after month he applied himself to the task when, thinking his work complete, he called his little daughter, three years of age, and asked her whom it

represented. "I do not know," she replied, "but it looks like some good man." Disappointed, but not discouraged, he again set to work and for nearly three years worked most faithfully to accomplish what he had determined to do. Again calling his child he repeated the question. In raptures of delight she answers "Oh! it looks like the Good Being, who, when upon earth took little children in his arms and blessed them."

Whether true or false this story of the artist serves well as an illustration, for every triumph of the toiler in any field only fits him for new struggles, only disciplines his powers for new conquests. Yea, every advancement made enlarges his mental horizon and gives him new and increased life. It is so in every calling, experience brings her lessons into the studio of the artist, the laboratory of the chemist as well as into the work of the mechanic and of the farmer. In the story related the artist is represented as having obtained perfection. It cannot, however, be said of the dairymen of to-day that *his* career has been so glorious. However much he has advanced he has other lessons yet to learn, other discoveries yet to make. His ideal has not yet attained perfection, nor have his powers to execute gone beyond his ideal.

There is yet a pressing need for the producer and consumer of dairy goods to cultivate a better taste and to get more correct ideas as to what constitutes superior goods. True it is that during the last two decades great progress has been made in the quality of goods produced. The causes which have led to this improvement are too numerous to here recount, but the fact gives us courage to believe in and to ask for still greater improvement.

The creamery system of butter making has wrought wonderful changes. This is seen in the great change that has taken place in late years in the demands of the market for fresh-made butter. The great mass of consumers want their butter directly from the churn, or as one has more happily put it, "they want their palate and the pasture brought as near together as possible." Hence the dairyman and his wife, who stubbornly refuse to make their butter in a way to suit the palate of the consumer because of their faith in the old way, are simply punishing themselves. Who, as they have had occasion to study this matter, has not often wondered how slow we have been to learn the right butter processes. The old sickle, the flail, the clumsy farm implements and the endless stick, stick of the housewife, have departed, but the old dash-churn of long, long ago and the heavy earthen crocks and the coarse salt are yet found in far too many households where butter is being made. But to-day along with our improved methods of farming, with improved stock breeding and improved farm machinery have come the newer and better ideas of butter and cheese and how to make them.

One has but to look back over the past twenty years to be thoroughly convinced that dairying is in fact an evolution, and further, it needs no argument to show that during this time dairying as an industry has achieved far more in art, skill and adaptation to the wants of the consumer than in all its previous history. Why? Because it was being all this time divested of what may be termed individualism, and was, instead, all the time taking upon itself the character of an industry.

Till within the last twenty years dairying in Pennsylvania was an individual effort and its offerings were the miscellaneous collections

of its thousands of farm dairies. It would be an interesting study to trace the growth of the dairy industry in each of the dairy States and see how the building of each factory and creamery put the industry upon a firmer, broader base, and put dollars into the pockets of those who saw its possibilities as they were able to widen the avenues of production on the farm. To cast our eyes westward and behold that wonderful innovation upon all precedent, the gathered-cream system that revolutionized the West, covering a number of States with its network of cream-routes and awoke the dairymen of the East to the fact that the West was bearing the palm off in quality of butter and was govering the price as well. To think of the far West becoming the recognized center of the dairy kingdom when for so many years Ohio, Pennsylvania and New York had thought themselves as perpetual sovereigns.

The factories that exist in some parts of our State have retired to oblivion the home manufacture of butter and cheese in those localities. But we find other parts of the State scattered all over with small dairies still making and putting upon the market a miscellaneous quality of butter and cheese, especially of the former.

The demand for good butter has never ceased. By the term good butter, we mean "good cow butter;" it consists of the perfect oil globules separated from the milk that has been properly handled at every step of the process, gathered or massed into such form as to practically exclude the air, yet not to break the globules. The grain is thus preserved, and the flavor must be perfect if coarse or dirty salt has not been introduced to ruin the product. The butter should possess life, should sparkle before your eyes and melt to sweetness in your mouth. Such butter as this you need never be ashamed to take to market, nor ever shun and abandon. Such butter as this every American will delight to eat. In contrast with this, how intolerably mean is a large percentage of that now called butter that is consumed by our people?

How to improve the product is the all important subject. Besides the great saving in labor and expense to individual farmers or dairymen in fitting up and carrying on butter making at every farm, there is the other stubborn fact that the mass of farmers will produce an article far inferior to that made by the coöperative or creamery plan. Here is the greatest improvement in the history of dairying, and the creamery system should be perfected and extended if dairying is to advance. All its great advantages we cannot here discuss, but taking in the whole problem, the creamery must stand as the foremost factor, and when its value is fully appreciated, when its methods and possibilities are better understood, it will have more universal prosperity than now.

One of its advantages we would mention is the economy of time in manufacture, for it simplifies the care of the milk and makes the rules that govern the production of cream uniform, and takes the burden of dairying from scores of farm homes and transfers it to a few skilled workmen. The old plans of dairying show no uniformity, and there are as many grades and qualities of dairy products offered to the consumer as kinds and value of money in the days of the wild-cat banks.

Except the private dairy on a large scale, the whole milk creamery combines most of the essential conditions of success in butter making, for it affords the practice of winter dairying, which is simply a plan

to make a cow produce milk when feed costs most and prices are long in advance of the summer quotations. In other words, making the dairy in winter turn a paying profit instead of being a combined bill of expense.

The actual want of the day is for the great mass of dairymen all over the United States to get out of the old grooves which they have been blindly following, and see that the product of their dairies shall be of a brand that shall command attention in the markets, and not, shall I say, disgust creamery dairying, whether it be coöperative or in the private dairy, has another element of success about it. Take it for the season through, fine creamery butter rules from five to fifteen cents per pound above the quotations of common dairy butter.

But by whatever method the butter is made, there are certain things to be observed in order to reach the standard we so much desire. Cause and effect sustain the same relation here that they do in other trades or walks of life. Certain forces or factors at work produce, under like circumstances, the same results. This being true, we must understand these conditions—these elements of success in dairying. For ignorance and stupidity are just as costly in the dairy business as in any other trade or profession. We have plenty of farmers not only in other States, but in our own as well, who would not spend a cent nor an hour's time to become intelligent on the dairy question. They think they can do all their business on what little knowledge they now possess. The era of high prices seems to be over, and the dairyman must get his profits from his cows in cheapened production, hence the greater the necessity of being bright and intelligent if he would make money in dairying.

Intelligence should be displayed in selecting cows for the dairy. A careful test should be made, for all are not butter or even cheese cows. Shelter well from the storms, and handle carefully so as to avoid all fear or uneasiness among the herd. Proper food and plenty of it, is very essential. Cows must be kept in good health or they cannot produce good milk, and without healthy milk good butter and cheese cannot be made. Feed regularly, use a variety of food. Sweet corn, millet and clover with corn, oats, shorts and bran. Cleanliness is a positive condition whether in barn, house or cellar. A musty cellar is an unfit place to keep milk. The cream should be removed before it begins to mold. It is safe to say that the cream should be removed within twenty-four hours after the milk is set. Cream should be allowed to ripen, this may be accomplished by putting it in a tin bucket, keeping it so that extremes of heat and cold are avoided, stirring it at times so as to keep it uniform; churn at a temperature of from 60° to 62°. Use about an ounce of best dairy salt to the pound. Don't work too much. Never draw ladle over the butter, but press firmly against, if ladle is used. Better far is the lever worker. We have stated these points in a very brief way, that these brief ideas, in so far as they are correct, may become the opinion and practice of all dairymen is my wish. It is intelligent effort we need. People should try the new and adopt all that is well. But, says one, I have followed the old way so long, it is too late in my time of life to make the change. It is told of Napoleon that late in the afternoon he rode upon one of the battle fields where his troops were becoming demoralized and beaten. Looking at the sun, he exclaimed: Just time enough to bring victory out of defeat! He at once set to work, reorganized his forces and soon won the victory. Why not make the effort? The demand

for fine goods is beyond the supply. The market quotations are always saying: "Give us more choice goods?"

Our American dairy interests are startlingly enormous. The New York *Herald* says: "They represent an investment of nearly five times as much as the entire bank capital of the country—that is to say, the bank capital is a little less than $671,000,000, while the dairy proceeds amount to more than $3,000,000,000. The value of our dairy products for the past twelve months was nearly $500,000,000. This is $20,000,000 more than the value of our annual wheat yield, while it closely approximates that of our corn crop, which is the most valuable of our farm products. It is easy enough therefore to see that the 400,000 farmers and dairymen in this country are an important element of our national welfare and prosperity."

THE FEEDING AND CARE OF DAIRY COWS.

By JOHN I. CARTER, *Chatham, Chester county, Pa.*

I intended, in this short paper, to speak mainly of the care and food of dairy cows, only premising that it is hardly worth while for a dairyman to waste time and good feed on a worthless herd. Of course the kind of a herd to select will depend on circumstances. It may not always be convenient, or even prudent, to buy high-priced thoroughbreds, though there is little doubt but that for a butter dairy the Channel Island cattle, with their crosses and grades, will be the most suitable, and, indeed, for practical purposes the grade Jerseys or Guernseys are probably more valuable than the thoroughbreds themselves.

But whatever breed may be bought, they should be good, strong cows, giving a good flow of rich milk. Even in a milk dairy rich milk is more and more sought after and commands an enhanced price, while for a butter dairy the superior quality of the butter made from rich milking cows makes them desirable and important. Having selected the herd the next thing is their care and feed. During the grazing season this is comparatively simple. With a good bite of grass and plenty of pure water they will need little else. They should have access to salt, and it is always best during the whole season to give two to four quarts of wheat bran at each milking time. This not only quiets the cow during that operation but is essential to make up the proper ration for her feed. If the pasture is exclusively of the tame grasses—that is clover and timothy—more meal or bran will be required than if the pasture is good natural grass meadows or what we call permanent pastures. The reason is evident. The tame grasses are only in their most nutritive condition for a few days—while in the full bloom of the clover—hence the cows must, for several weeks, feed on either immature or over ripe grass and not in its best condition. But this condition is not so marked in the natural grass pastures. It is of a more mature character throughout the season. Green grass is nearly always a rich, nutritive grass, and it is quite desirable to have one field at least to make a daily change for the cows. They will visit each part of the range every day.

Summer Soiling.

Every well-stocked dairy farm is in danger some part of the season

of being short of pasture, and this has to be provided for by soiling crops. Among these the most important is sown corn, sown at different times to secure a more continuous feed. I doubt if rye or clover are either very profitable soiling crops. It is difficult to keep them many days in their best condition. The rye especially is in its best estate only a few days. It is either very immature or too ripe. It is the same with clover but to a less extent. This difficulty, in connection with the inexorable labor attending the feeding of it, is a serious drawback to the adoption of the soiling system as a systematic or exclusive plan of feeding cows. This daily going to the field, cutting, gathering and hauling in, wet or dry, hurry or leisure, is a burdensome as well as an expensive job. When we learn how to silage crops successfully we may be able to summer silage our soiling crops and be enabled to cut our soil crops in the proper state, and thus secure its best condition and make one job of cutting and putting up each different crop, and thus make quite a saving of time and labor.

Stabling the Cows.

It is good policy to keep the cows in the stable during the hottest part of the day in summer, provided there is a well ventilated and roomy stable for their accommodation. If the stable could be darkened it would secure them from the annoyance of the flies, and be cooler and pleasanter. The stable should be supplied with water, that the cows should have plenty of drink without unnecessary effort in obtaining it. No part of a milch cow's sustenance is of more importance than its supply of water. A cow that will give sixty to eighty pounds of milk daily, eighty-seven per cent. of which is water, to say nothing of the supply needed for the various secretions of the body, must have water in full supply to keep up this heavy drain.

Perhaps dairymen suffer more from the neglect to furnish suitable drink for their cows during the feeding season than from almost any other one cause. They may get their water regularly, or in insufficient quantity, or tramp long distances for it and often ice cold. This latter is a very unsuitable condition for a sensitive cow, to whom warmth and comfort are essentials, when making a full flow of milk.

A cow will not drink as much water at a low temperature as she really requires, but this little of ice water is enough to make her shiver, and shrink up several quarts of milk.

Cow Houses.

The time will come when dairymen must construct their cow houses with an eye to the comfort of their cows and the economy of time in feeding and caring for them. The basement of our common barns are altogether unsuitable. It is difficult to have either well regulated light, or ventilation, both being absolutely essential in the proper care of cows. In a cow house, separate from the barn, and constructed with a sole view to the comfort and convenient management of the stock, you can have control of every feature of it. In such a building you can have a heater-back stove arrangement, reasonably fire-proof, that would temper the drinking water, or warm that to be used for mixing the meal and cut feed. This cow house will be much safer from fire, and present less risk to stock, because it can be made less combustible, and afford better facilities for releasing and getting out the stock.

Every few days we read of barns burnt with their imprisoned stock

perishing in the flames, because they could not be approached or driven out. If we relieve our storage barns of this stabling feature, and allow the bays to run down to the ground, they will not only hold more, but can be built with lighter and cheaper timbers. This saving will go a long way towards the construction of the separate cow house. The increasing practice of cutting and moistening the winter feed of dairy stock makes the transfer of the feed from the storage barn a matter of less moments. Its transfer in the mixing boxes on suitable carriers, is easily and quickly done. In addition to this there will be a steady increase in the amount of fodder and coarse foods ensilaged, the building for which can be placed near the cow house instead of by the barn.

Silos.

The storing of winter dairy feed in silos is attracting more attention from practical farmers. The fancy farmers, at first, carried the thing to an extreme, or rather went faster and farther than could be sustained by sound practice, and brought some discredit upon the theory that it did not deserve; first by doing the thing in an expensive manner and expecting too much of the product. I think there is no doubt but that a cheap and healthy food for dairy cows can be secured by the use of silos. I see no serious difficulty in the way of putting up in the silo one field of corn intended for dairy feed, in better condition, and less actual expense, than as at present managed. Take one field corn crop, as at present raised, and see what it costs to thin out, husk, crib and grind the corn. By actual test, it cost this year many of our Chester county farmers one-eighth the crop to husk it and another eighth to have it ground, to say nothing of the second handling of the corn. The cutting off of the corn and the cutting of the fodder is the same in both cases, and the hauling to the barn cannot be so very different, except the somewhat increased weight. Theoretically, the crop in the silo would make a feed more assimilable, and a great deal cheaper, counting the labor from beginning to end, than if stored in the usual way.

An acre of well-grown and well-eared corn will make ten tons of corn and fodder ensilage, and I believe would keep three to four cows for eight months. Perhaps a little bran or cotton seed meal might be needed to make the ration more complete. If this be all true, it looks like the most satisfactory way we can handle our corn crop, at least such portion of it as is to be fed to stock. All the work can be done in the long pleasant days of fall, and the ground thoroughly cleaned for a wheat or rye crop. But neither siloing nor ensilaging will become universal for many a day yet, for under many conditions its adaptation will not be practicable.

Cutting and Mixing Feed.

The advisability of cutting dry cornfodder and hay for dairy cows, is now recognized by many of our best farmers. The feed goes further, is more convenient to handle and when moistened, makes a better medium with which to mix the meal that is to be fed with it to complete the ration. Wetting the feed for dairy cows is an important matter, it makes the feed more palatable, it keeps the meal ration well distributed through the whole mess and is taken into the stomach in better condition to be acted on by the digestive fluids. The feed should not be made sloppy, but thoroughly dampened by twelve

hours' previous mixture with warm water. This treatment seems to bring out a pleasant odor in the mess, and makes an agreeable feed to the cows.

As to cooking cow feed, either by steam or otherwise, I doubt if it adds anything to its digestibility, particularly if it is cornfodder or hay; at any rate the increased expense of the operation would far outweigh any advantage.

A Proper Meal Ration for Cows.

We have a good deal to learn yet as to the proper combination of food material that should produce certain results. The selections to be made from those that are at hand, or otherwise the cheapest. It is easily understood that a cow requires certain nutritive elements in her food to keep her in health and producing milk. These elements are usually classed as albuminoids, carbohydrates and fats—they must be in proper proportion, because if there is more of one than is required, it is not only wasted, but likely a detriment. Then again, these elements must be presented in a palatable and digestible form; and last, but not least, must come from the cheapest sources available. The arrangement and proportening of these food elements, to secure a specific object, as for instance the production of milk, is a matter for earnest study, and much of the success and future profit of dairying will depend on how well this is done. The farmer, as a general thing, is limited to a few crops to furnish these foods, a few others are purchasable. It will devolve upon every community to make its own selection, because the crops and cost vary with the neighborhood. In our section we feed cornfodder, clover or mixed hay, wheat bran, cornmeal, cobmeal, oats and cotton seed meal. One pretty successful dairyman, near me, whose nineteen head of cows produced 17,515 pounds of milk in November and December last, and which sold for $271 at the creamery, fed the following ration:

Cost of Food Rations.

Four quarts of cobmeal, weight 4 lbs., at ¾ cts. per lb., cost	3 cts.
Ten quarts wheat bran, weight 5 lbs., at ¾ cts. per lb.,	3¾ "
One and a half quarts cotton seed meal, weight $2\frac{1}{10}$ lbs., at 1¼ cts. per lb.,	2¾ "
Whole cost of meal ration per day,	9½ cts.

Of Coarse Feed.

Eight pounds cut cornfodder, at 3 cts. per bundle,	1½ cts.
Four pounds cut clover hay, at $10 per ton,	3 "
Whole cost of fodder,	4½ cts.

This was wet and mixed and divided into two feeds. If we allow the cost of the fodder and hay to be offset by the value of the manure we would have a profit on each cow over the cost of the meal of $4 25 per month for these winter months. Other neighboring dairymen made about the same results, but varied the ration by leaving out the cotton seed meal, and feeding more bran, which made their feed cost rather more. But none of these results are what they should be, when we appreciate the fact that two-thirds of a full ration goes to sustain a cow in her normal condition, and only the other third goes to make the production yielding profit. When we learn also that a cow can be trained to assimilate more and richer food and her product thereby

largely increased, and this progress going on for years—when we learn the wonderful capacity of a well-bred, well-fed, and well-cared-for cow, and how to produce and feed the most economical foods in the very best way, we will then begin to make dairying a popular, profitable and satisfactory business.

THE GENERAL PURPOSE COW.

By J. C. THORNTON, *Member from Erie county.*

The subject of cattle growing is one that is enlisting the attention of the best minds in the country.

Each year the subject is becoming better understood. Valuable improvements are being made in our cattle herds.

It is not my purpose at this time to enter upon the general subject of cattle breeding, except so far as is necessary to present my views of a general purpose cow.

I know of no branch of the subject of cattle growing that more generally effects the masses of the people than the question of the requisites of a cow that is best adapted for general purposes.

Milk and beef are the chief objects to be obtained. An animal that does not combine these two primary elements is not a general purpose cow. The possession of either of these qualities without the other does not fill the requirement.

A general purpose cow must be such as to meet the requirements of the greatest number of people. The wants of the people are varied in this respect, and you cannot, in the full sense, meet the varied wants of all by an individual animal.

Some want milk, some butter, some cheese, some beef, and some want all from the same cow.

For the purposes of milk, butter and cheese, we want quantity and quality.

For the purposes of beef we want size and quality. These elements must all be conceded to be essential to the general purpose animal, and while such a cow may not especially excel in any of these requirements, she must fairly meet them all.

I maintain, as the result of more than twenty years' experience and observation as a breeder, that such an animal can be produced by judicious and proper breeding. I have no hesitation in saying that the large class of breeders have hitherto given too little attention to this important feature of the subject of breeding.

Too many of our breeders are what I call specialists, some breed specially for the beef qualities and ignore the milking qualities. Others breed more especially for the milking qualities and disregard the beef qualities.

Both are necessary; neither course will or can produce the best general results. In neither way can you produce a desirable general purpose animal.

Intelligent breeding requires close attention to both milk and beef qualities and these should be sought for in both sire and dam.

The milking qualities of a cow must be considered with reference to quantity and quality of the production.

Some cows produce a large quantity of milk that is comparatively

valueless in quality. Others produce milk of fine quality, but in small quantity. Such animals might answer the purpose of some people but would not meet with favor from the general public.

I want a cow that produces a good quantity of a good quality of milk which I can use for general purposes. I want good flavored milk for use in the family. I want at the same time a quality of milk that will produce a liberal amount of good quality of butter and cheese.

Milk of different cows varies as much in quality as it does in quantity. This is demonstrated not only by the difference in the butter and cheese made from it, but by its effects in family use and upon the offspring of the animal.

It is an actual fact that the milk of some cows is wholly unfit for children and cannot be used for them. The milk of some cows is poisonous to their own calves, and they die from the effects of it. Yet the milk of these cows may be, and generally is, good for cream and butter.

I want a quality of milk that is adapted to the general needs. I don't want a cow that does not produce it, and in paying quantities.

I don't want a cow that won't raise *well* one calf. I want a cow that will raise two calves well.

I would say that a general purpose cow ought to give from forty-five to fifty pounds of good milk per day in height of milking on good feed, and many will do more. That she ought to give milk for at least ten months of the year. Some cows will milk for a longer period, but I am opposed to allowing them to do so on general principles.

With the milk quality I insist that we should combine the beef quality. When the cow is no longer useful for milk then let us have a cow of size and form that will respond to feed, and when fattened for beef weigh, on foot, from 1,400 to 1,600 pounds. An animal that when killed furnishes a quality of beef fit for the table of any one. I want a cow that will readily fatten, when dry, with reasonable feeding. A cow that won't do this is not fit to be called a general purpose cow.

For a general purpose cow I maintain that a thoroughbred is the best, and for that purpose I would not recommend the breeding of any other, although I do not say that good results may not be attained, in some instances, by the breeding of grades.

What I mean is that the best general results will be obtained by breeding thoroughbreds.

As to what particular breed is best adapted for the development of general purpose cows, I am aware is a matter of a great difference of opinion. Each breeder will assert that the breed he is engaged in breeding is the best. I concede the right of any one to maintain, if they can, that their favorite breed is the best.

There are many breeds of cattle well adapted to specific purposes and which I greatly admire when purely bred. Nearly all of the improved breeds are valuable for some particular purpose. There are some of them that are well adapted for general purposes, and this class is the most valuable, therefore, when you begin to breed you must determine whether you want to breed for general or specific purposes and breed accordingly.

If you desire to breed for general purposes then the question arises, What breed should we take? I would say take the Shorthorn. The history of this breed of cattle demonstrates that they are the best gen-

eral purpose animals. They are the best adapted to the general wants of the masses. They are good breeders, large and symmetrical in proportions, good for milk and butter, and second to no breed in the world for beef. They are hardy and will adapt themselves to our diversity of soil and climate better, in my judgment, than any other breed.

The Shorthorn is the oldest breed of cattle of which we have a straight lineage. The Shorthorn is not only in my view of the case, when properly bred, the best pure bred animal known, but when crossed with other breeds invariably transmit their characteristics to the offspring. I have failed to find any other breed on which I can depend with as much certainty in this respect.

Every careful observer of grade Shorthorns will concede the truth of this proposition. This fact makes the Shorthorn very valuable as a means of improving other breeds in beef and milking qualities and makes them as a breed generally sought for by intelligent cattle breeders for that purpose.

You can scarcely find a herd of cows kept for milk and butter purposes that does not contain a number of either pure bred or grade Shorthorns, and the Shorthorns are generally rated by the owners as the most valuable of the herd. This affords a reason why so many are desirous of obtaining thoroughbred Shorthorn bulls for the purpose of crossing with other breeds. In fact experience clearly shows the Shorthorn to be the best of all breeds for crossing purposes.

There are so many valuable families of pure bred Shorthorns that it is impossible in this discussion to do justice to them all. I shall therefore confine my remarks to the justly celebrated family which is known as the " Princess family," it being in my deliberate opinion the best adapted to general purposes of them all. I express this opinion well aware that many intelligent and successful breeders and admirers of the Shorthorn will take issue with me on this point, but this only demonstrates that we don't all think alike on this important subject.

We learn from what seems to be reliable authority that this noble family originated from a cow bred by Mr. Stephenson, of Ketton, England, in the year 1739.

This is undoubtedly the oldest Shorthorn cow which can be traced as the foundation dam of any breed of which a record in unbroken line has been preserved. This family was introduced into this country about the year.

They were first introduced into the Eastern States, where their superior milking qualities were highly valued and where they have been bred pure to a limited extent.

It is only a comparatively late period since they were introduced in the West, where they are rapidly growing in favor and where they are developing desirable beef qualities as well as maintaining their milking qualities.

Much more might be said of this noted family but time will hardly permit of speaking more at length on the subject.

In conclusion, I would say that for a general purpose cow, one that possesses in an eminent degree all the general qualities desired, there is none that can successfully compete with a Princess Shorthorn.

DAIRYING FOR WOMEN

By WILLIS P. HAZARD, Esq., *West Chester, Pa.*

It is a topic which at once presents itself in two aspects, both the poetical and the practical. From the derivation of the word dairy, woman has a right as queen of the dairy to be associated with it and its products. For dairy is the *ry* or *rie* or dominion of the *dey* or farm woman. Do we not read in Scott's Fair Maid of Perth:

"The dey or farm woman entered with her pitchers, to deliver the milk for the family."

The dairymaid, from her rural associations, from our gratitude to her as the means of dispensing the lacteal fluid, the maker of the butter and our cheese grateful to the palate, and through her love for the cattle has been always the favorite of poets and artists. She is associated with our earliest nursery recollections, where the infantile mind receives its first impressions of love, in the ballad "Where are you going, my pretty maid?" and in that of "The cow with the crumpled horn." More ambitious poets sing of her in more stately rhymes, and artists love to depict her "tripping o'er the daisy mead." Who is not charmed with the recent pictures of "Jersey," "Alderney" and "Guernsey," where blithely

"Forth comes the maid, and like the morning smiles,"

surrounded by her beautiful and lovely pets? However much we may love the soft-eyed, gentle pets, the pictures gain more than half their charm from the poetic associations of the central figure of the dairymaid. The artist, with the license allowed him, has delineated the dairymaid as the most poetic of creatures; writers on the Channel Islands have made her the fairy of the most embowered glades. But how different the reality, descending from the poetical to the practical. Women are employed by the islanders to tend their cattle three times a day, to change them in their pastures at noon by newly tethering them, to take them out in the morning and bring them in at night; but neither the poet nor the artist would select these dairymaids as models for pen or pencil. Peasants of Brittany, these Britons are emoloyed to come over from the mainland to work for the islanders at a moderate pittance for a portion of the year. They are frugal and virtuous, plain and coarse in physique, living on the bread they make up on Sunday for the week's supply and the allowance of cider from the master; sleeping in the barn, dressed in homespun of their own manufacture; their heads, if covered, sheltered by an unattractive sun bonnet or cap, with a three-cornered kerchief or shawl around the neck; they stride along in their great wooden sabots with strong step and masculine air. They spend no money in finery or personal decoration, but when their summer contract is over they return to their "la belle France" with their sum total of wages hoarded up to assist in their winter maintenance. No work is too hard or beyond them, and they seek no recreation beyond their simple gossip after their twelve to fourteen hours labor. Truly that is the practical side for these dairymaids.

Cross we to Holland and here we may find a model to prove that the dairy may be woman's profitable and suitable sphere. With the stable and the dairy a part of the dwelling, with such scrupulous neat-

ness in both that the sabots are left outside and clean slippers put on, with the cows' switches combed and brushed, the tails tied up out of the way and decorated with ribbons, here

"As unambitious, too, that cheerful aid,
The mistress yields beside her rosy maid,
With joy she views her plenteous reeking store,
And bears a brimmer to the dairy door;
Her cows dismissed, the lucious mead to roam,
Till we again recall them loaded home.
And now the dairy claims her choicest care,
And half her household find employment there."

The wealth and thrift of the Hollanders is proverbial, and it is mainly due to the dairy products of a country no bigger than the State of New York, which lays under tribute every part of the world, and of which women have so large a share in their manufacture.

Following the Rhine, one may see the dairymaids, at earliest dawn, accompanied by their herds of cattle and goats, winding their way up the mountain to pasture the stock, and make those cheeses which have made Switzerland famous for her "Gmyere" and her "Neuchatel."

In England's Devon we have seen the dairymaid, with her taper fingers, churn, in a few minutes, in an earthen bowl, the freshest of butter. At Berkeley Castle "my lord" bade us eat of his "double Glo'ster" and wash it down with his home-brewed ale. Such cheese as his dairymaids made lingers on the palate and the memory forever!

Then shall not our American dairymaids put their intelligence and skill to such delicious handiwork? Equipped suitably, and yet with that coquettish touch which the women of no other country can surpass, as she turns out the golden pats of butter, what more dangerous sight for the heart of the young farmer, especially after he has eaten of her aromatic product on the flaky biscuit of her own make?

With all the modern facilities of making butter and cheese, the labors of the dairy have been much lightened, and we know of no opening for feminine occupation which will bring in a surer and steadier income. With a determination to make only the best, to seek special customers so as to get the best price and maintain a uniform quantity and supply, no need despairing of profitable returns. Those situated near large cities can open up new and independent markets by varying the products of the dairy. There never was a time when the people are more willing to eat much of attractive dairy products and pay the largest prices for genuine articles of the highest merit. In addition to butter of the danitiest appearance and best quality for the ordinary market, butter put up in little pats ready for the table and without salt would find paying customers, not only among the French portion of our population, but among the wealthy classes. Cream made in the Devonshire fashion and sold as clotted cream would be very remunerative and is easily made, and the milk, not too heavily skimmed, can be made into curds and whey, sometimes called junket or cold custards. So also with cheeses; cream cheeses and Neuchatel cheeses are easily made. We remember well in our boyhood our semi-weekly visits to the market and bringing home, from an old lady living a few miles out of city, who brought cream cheeses about the size of a tea plate and an inch or more thick, selling them at an average of about twenty-five cents each. The curds she made in a large vessel in the market, putting the rennet in

the milk she brought in early in the morning, before her customers arrived, and dipping it from her tub at so much per dipper into our kettle. The curds made a delightful breakfast addition and the cheeses were nice for supper. Of course the skim milk made into smearkase or cottage cheese is profitable and will have a steady demand at a great profit if not scalded too much to make it lumpy. The tact to put into the market palatable articles from the dairy is the first requisite for getting a remunerative and steady trade, and these hints may be much enlarged. There is one advantage, competition is not great, few taking the trouble or giving the thought to these things, and the majority of dairy people living distant from the cities, the largest customers for such dainty products.

Of course, to insure success, a good selection of cows must be made, and of a dairy breed, as well as to have all the dairy adjuncts. No better breed is to be had than the Channel Island breeds; their quiet and patient bearing, their rich and continuous yield eminently fit them for the purpose, their milk when skimmed showing a percentage of over two per cent. of fat, proves it as being most valuable for using for making into the cheaper class of dairy products. The calves, too, should be counted in as a source of profit.

Now what is there to prevent women entering into this employment as a source of profit to those who are properly situated for it. The work will be steady and require continuous attention; female help can be employed, but the services of one man will be necessary for the heavier chores. With flannel clothing, rubber apron, short skirts and rubber-soled shoes, for use in the dairy rooms, to be changed upon returning to the house, the health can be maintained and be kept superior to that of the piano playing miss.

The profits of good cows would be apt to be increased by the daily attention of interested women. Proper feeding and good care, combined with regularity and gentleness of attention, will largely increase the yield of any herd. A farmer in Newark, New Jersey, kept a strict account of the yield of three Jersey cows, and he cleared a profit in one year of $456 after paying for their keeping and supplying some milk and cream to the family.

Success in raising and making the dairy products must be accompanied by tact in marketing them; this is fully one-half the battle for success. Every thing must be surely good, put into the most attractive form and the best prices obtained. We hear of notable instances of success by women and others in making and marketing their dairy products; one we may recall of a Danish lady whose sales have annually increased, and she has made a fortune which she is still increasing. The London Dairy Company and the Aylesbury Company have most attractive shops in London where large quantities of dairy products are sold. A recent instance is in New York, the owner quickly was compelled to enlarge his premises. Another instance in Washington is notable and his success insured. The great demand for buttermilk has added much to the revenue from the dairy.

We believe the question may be answered in the affirmative, that the rearing of fine cattle is open to successful following by women, and that it will bring health and independence, and of course they include happiness. We need not say how superior is the workman who employs the mind advantageously in this work. The hands are instruments of labor, but what is the work worth if it is not done with the heart and the head as well? The quality is regulated by the ca-

pacity and the interest of the workmen, and the labor is one-half lightened.

The farm of Mrs. Hannah Neilson is of 170 acres, fourteen miles from Copenhagen. The comfortable and substantial homestead is thatched with reeds, and is entered through a covered passage opening into a court yard surrounded by the barn, dairy buildings and stables. The cellar of the house is sunk partly below the ground and is used as the milk room, churning room, the kitchen and scullery and the servants' apartments. The milk room, from its low level, is easily kept cool and there is an ice house also.

Soon after four o'clock the daily operations are fairly under way, Mrs. Neilson and her eight dairy maids, who are her pupils, taking an active part. These pupils are from good families and go to Mrs. Neilson to learn the art, to fit them for dairymaids, dairy teachers or as heads of households. This is another point to which we call attention, the opening for good dairy women to become teachers of the dairy art. In England there is a dairy school which visits different sections of the country, conveying instruction and visiting the fairs, and the dairy maids exhibit and perform the practical operation of the dairy.

At Mrs. Neilson's, as the milk from each cow is brought in, it is weighed and recorded, which in a year shows the actual yield of each animal and the income from the produce. The milk is put into deep, narrow cans, and they are placed in brick-and-cement tanks two and one-half feet deep and two feet wide, through which runs water cooled with ice. This is the Swartz system and rapidly throws up the cream. After standing for twelve hours the cream is skimmed off, put in the cream can with a little souring and stands for twenty-four hours. Then it is brought to a temperature of 56° to 58° and churned in a dash churn of the Holstein pattern. When the butter has come in a granulated state, the milk is drawn off from the bottom, and cold water is put in and the butter washed until the water runs off clear. It is put into a tub, pressed with beaters until the water is extracted, salted with about three per cent. of salt, allowed to stand for twelve hours, when it is reworked and packed. The skim milk is at once made into cheese after being skimmed. These cheeses are of the Cheddar and Edam makes, also a small round cheese the size of a plate and an inch thick, which is soft and creamy, much like the Boil cheese, and sells for about twenty-five cents each.

All these fancy cheeses and her butter are sold in a very attractive way in her own shop in Copenhagen. As not only are they excellent, but as the royal family are supplied by her, she has an active demand at the best prices for her goods, and she is making much money. They are stamped with the royal arms of Denmark, and sold in clean little pots of one or two pounds each.

In Denmark the government has taken active interest in promoting the dairy products, established scientific and dairy schools, and that country stands in the foremost as a dairying country.

There is no reason that the profitable example of Mrs. Neilson should not be carried out in this country. The first thing to do is to educate our people up to the fact that the majority of butter made is a disgrace to American intelligence and handicraft. The next is to learn how to make nothing but first-class butter, and to take lessons of noted butter makers, if necessary, until proficient, and this is soon done with the application of cleanliness, intelligence and unremitting, careful attention. The next is to have thoroughbred cows or high grades of

known dairy breeds, such as the Guernsey and the Jersey, for their butter is of firm grain and high flavor. Then these should be well fed with good, sweet food, not the refuse moldy hay and cornstalks so often thought good enough for the cow, for the flavor of the food goes immediately to the milk. The stable should be tight and warm, clean and free from foul odors, and the cattle kept clean and brushed, and the udders always washed before milking. Cleanliness is necessary from the water the cow drinks until the butter is sold.

The marketing is the remaining half of the battle; the eye predisposes at once the rest of the senses to view favorably the attractive parts of butter; not only must the article look attractive but the seller must be so, as no one is attracted to anything eatable if handled by a dirty, frowsy looking person. Let your butter be stamped with a mark you can point to always as a guarantee that that article is pure butter and of uniform quality, and the list of customers that will soon be made will be kept and increased and the article be bought without sampling it. If you are not so situated to open a shop in your nearest large town or city, or even to attend the market, advertise and visit the houses until you have your list of customers made up; get those who take it to recommend it to others. If this is not possible visit the largest city within one hundred miles and make arrangements with some leading grocer or seller of butter or produce to receive it regularly and dispose of it for you, and weekly send you the returns. The express companies take down the full cases and bring back the empties for a small sum per one hundred pounds. This business will grow very much now, for fear has struck the consumers in these days of vile adulterated products and they will pay a good price to know they are using pure butter. And as this demand increases the area from which the supply is drawn will extend one or more hundred miles further. The demand to-day is for fresh-made butter, and the extreme Western States are partly supplying that demand by their daily shipments East. No longer is the poorly made country butter of all colors, smells and tastes desired by the country store-keeper to work over into a uniform compound, to be packed away in tubs or in rolls, to be shipped by the barrelful to half pay his grocery bills in the cities. Such stuff is now marked lower than ever and degraded below competition with butterine, oleo and other such villianous compounds. The difference in the cost of labor in the production of first-class and of inferior butter is infinitesimal compared with the difference of price obtained for the two.

The dairy interest never was more depressed, and just at a time, too, when there never was a greater demand for best butters. Creameries are fast filling this demand, and in this sense they are of vast benefit to the consumer and to the farmer in furnishing him a ready market and saving him the trouble of butter making; but, at the same time, their receipts, and, of course, that of the farmers, is much cut down by the bogus butter factories who imitate their wares. This can only be stopped or palliated by the government placing a tax upon all such products as they do upon whisky and tobacco, and passing a general law against selling the product except for just what it is.

All our county and other agricultural societies should employ skilled butter makers to teach the art.

PRACTICAL DAIRYING.

By E. BRINTON, *West Chester, Chester county, Pa.*

By practical dairying we mean profitable dairying, and profitable dairying means lots of hand and brain work. The idea that fine brains are needed to make a banker, merchant or professional man, while any intellect will do for the farm, is all wrong, brains are needed as well as muscle. A man to-day, in Eastern Pennsylvania or in fact in any of our Eastern States, who makes a dairy farm pay for five years, shows an amount of business ability equal to that displayed in any calling. The ideas or suggestions conveyed in this article are not particularly intended for the wealthy farmer or dairyman, who can afford to pay his hundreds for cows, and his thousands for stables, who can afford to have an attendant for every half dozen head of stock and to whom it makes very little difference if his butter costs him double what he receives for it. Such experimental dairymen are valuable; for the poorer farmer could not afford to try such expensive experiments yet he can learn from the results. But this article is intended more for the struggling farmer, who depends altogether on the receipts of his dairy and farm to meet his expenses. He is bound to be as practical as possible. From all sides we hear the cry, farming does not pay, and we need no better proof that these complaints are in a measure true than the frequent financial failures among the tillers of the soil. But very often these unfortunate failures are caused by the shrinkage in the value of real estate. Many farmers who bought their farms years ago, paid half cash, then gave a mortgage for the balance, find their places to-day worth in the market scarcely more than the mortgage. Not but that it is as fertile and productive as when he bought it but since then the great West has been developed until it has become the eastern farmers successful competitor in the production of the cereals, pork, butter and in fact nearly every production of the farm, and of course this cannot but lesson the value of the land for farming purposes. Besides this the farmer finds the taxes higher than when he commenced farming, the mode of living so changed, with the advancement of the times, that he finds it takes nearly double for household expenses that it did forty years ago and labor much higher and uncertain. So all together it is not to be wondered at, that a number of farmers have succumbed to these unavoidable circumstances. Yet many are not only not complaining but admit they are making money, and generally they are the practical dairy farmers. We alluded to the west being a competitor for our eastern butter trade. This fact was brought very forcibly to our notice not long since. A large, wholesale Philadelphia butter dealer showed us a consignment of packed butter he had received from Iowa, it had just come in prime condition and was very fine butter. The price he paid for it was several cents below Philadelphia quotations but we queried would not the freight charges for such a distance more than make that up. He then stated that it cost him, delivered in Philadelphia, less than one-fourth of a cent. per pound, while it was costing shippers within twenty-five or fifty miles of Philadelphia twice that amount. Nor could we charge railroad discrimination in favor of the west for all this difference in freight. The butter had come in on through freights, in car load lots and refrigerator cars, while we

within twenty-five or fifty miles of large cities have only local freights (which would be ruinous to butter,) and ship in small lots; the consequence is we are driven to use the express with its high rates. It is a fact that will demonstrate itself to anyone who will thoroughly examine the subject that our eastern farmers cannot afford to make butter, market it, and take the prices quoted in our eastern cities, and we maintain they do not have to, they can beat these prices if they will. In all our large cities there is a demand for first-class print butter for table use that commands a price far above quotations. We will find that nearly all well-to-do families, first-class restaurants and hotels are using it when they can get it, and this demand will grow with the population. Now what we must do is to let the great west furnish the tub and firkin butter for the masses; but we must supply the fancy prints for the high-toned tables and they will always pay a price that is profitable. This kind of trade must have first-class butter every week in the year; not only must the quality be regular but the supply must be kept up throughout the year. If a farmer has the notion that it is does not pay to keep up the supply of his dairy products through the fall and early winter, and that his customers will patiently wait until he sees fit to again furnish them, why the sooner he gets rid of such an idea the better. While it is undoubtedly true that no inconsiderable number of farmers will continue butter making because the demand for their extra goods makes it more profitable than any other way they could dispose of the proceeds of their dairies, yet the signs of the times point to the creameries as the butter producers of the future and upon the prices they are able to pay the farmers for their milk, depends very much the success of our dairy system. Throughout Eastern Pennsylvania, the creameries have been able to return the farmers, on an average, about three cents per quart for their milk the entire year, while some farmers maintain that will do very well, others are equally sure they make no money. And there is no doubt that both statements are true, as every thing depends on the management of the farm and dairy. The practical dairy farmer makes all his farming plans subservient to the dairy's interest, as he depends upon that for almost his sole income. In the selection of his grass seeds he recollects that he wants not only plenty of pasture but the very best of hay and that most suitable for a winter dairy. How often it has happened that the products of a dairy have been injured for a whole winter because the hay was spoiled when being harvested. Surely another very important matter in connection with dairying, is the water that the cows drink. Pure water is not only necessary for the health of the animals but absolutely required if the proceeds of the dairy are to be first-class. Impure or stagnant water will taint the milk, and so the butter, to a degree that sometimes unfits it for sale. When the proceeds of the farm are the farmer's sole income it would seem not practical to buy high-priced thoroughbred stock. While the outlay for such a dairy is very considerable the risk of death is just as great as with the common stock, and the result, in marketable dairy products, is often but little more. It is a mistake to ever buy any but a first-class cow; but for satisfactory results a milk or butter dairy should not cost over fifty to sixty dollars per head, and then the cows should be kept in such condition that if at any time one or more is found unprofitable to longer keep in the dairy, they could be sold at but a small sacrifice to the butcher. Nothing is harder on the profits of dairy farming than to buy a cow for fifty dol-

lars and keep her a year then sell her for twenty dollars. Is it not a mistake for farmers to have to buy cows after they once get started? Should not two or three calves be raised every year from the best cows in the herd? What they eat will scarcely be missed on a well-regulated farm. They come into profit in two years, and should they prove unfit for the dairy the butcher's price will pay the expense of raising. This thing of farmers having to take money out of their pockets to buy a few cows each year to replenish their dairies, is very hard on the year's profits. During the pasture season, if the herd has plenty to eat and drink, they will keep themselves in good condition and make satisfactory returns, but during the time they are stabled is when their owner must bestir himself if he will make the most of his dairy. In the first place he must be convinced that a fall and winter dairy is absolutely necessary to make his business a success, if he makes his own butter, or if he sells his milk, to make that of the party who buys it successful. That brand of butter will surely be more desirable and bring a better price that the consumer can depend upon the entire year. This applies equally to the creamery and the individual butter maker. Undoubtedly the creamery system will not reach its most successful point until its patrons are convinced that it pays both them and the creamery operator, for their interests are identical to keep up the supply of milk nearly the same the entire year; finds this: Does not the farmer have more time to give to his dairy and its products during the winter season than any other season of the year? Are not the prices of these products nearly double what they are during the spring and summer? And does he not have his cows to keep anyhow? and they might as well be earning their food. Also, is not the manure made by grain-fed cows better than that made by stock fed on hay and fodder only? The plan we advocate is to have some of the dairy to come in profit every month of the year, so that at no time will the dairy be very flush or get nearly dry. Upon careful inquiry among farmers of Chester and Delaware counties, we ascertain that it is not uncommon for the gross receipts of a dairy to average eighty dollars per head for a year, while some dairies will go as low as fifty dollars; yet in both cases the herds are composed of common drove cows. There is no reason why a cow should not be made to bring in at least seventy dollars every year. She should milk 330 days and average seven quarts per day, counting the milk at three cents per quart, will make just about the above sum; or, if butter is made, that amount of milk should make at least 250 pounds, which, at twenty-eight cents per pound, will make seventy dollars again. We know there are many dairymen who will say they have cows that will do far better than the above. But we are alluding now to entire herds of common cows receiving good attention the entire year. Not to one or two extra animals that are forced with an amount of feed and care which cost more than the result will warrant. It is the farmer's place to know just what his dairy is doing; not for any one month, but for the year. But too often he does not know. He forms his opinion whether or not his dairy pays, by the condition of his finances. If much less than the above mentioned amount is being received from his herd then something is wrong. It may be a number of inferior cows that are causing the trouble, or they are not milked or cared for properly, or the products of the dairy are not handled in a way to bring good prices. Be it what it may, it is making all the difference between profitable and unprofitable dairying, and he should not rest until he

has found and corrected the evil. A dairy that will bring into the farmer's pocket seventy dollars per head every year surely will pay better than anything else he can do with his farm. Take, for instance, a farm of 100 acres of cleared and tillable land, of fair productiveness, on such a tract should be kept fifteen cows and the farm should produce everything needed for these cows except about $100 worth of bran to mix with the cornmeal, which, surely, with an occasional change of cotton seed meal or roots, is the most practical feed we have.

Now if this dairy of fifteen cows brings into their owners coffers $1,100 during the year, and he spends but $100 for their feed, surely the other $1,000 will more than meet all other expenses. The above is not theory, but taken from the experience of many practical farmers in our section. As was stated, fall and winter is when the cows must be carefully looked after. They must be stabled at night before the grass gets too short or the nights very frosty; for if the supply of milk is let fall off by want of care or insufficient food before the herd gets regularly into winter quarters, it is almost impossible to bring it up to standard again. Remember, when they get into the barn regularly, the cows must depend upon you for every want, and if you expect the best results, see that every want is gratified. Feed them at regular hours, plentifully, on the best of feed. Spoiled hay or grain pays better in the manure pile than forced into the stomachs of the dairy. See that the feeding troughs are kept clean and sweet, have the stables warm, with plenty of bedding. No farmer is so poor that he cannot afford to have comfortable stables for his milking cows; he will lose more in one season without them than they will cost. It is very important that the milking should be done systematically, as nearly as possible at the same hours every day, and it is an excellent plan to have each milker milk the same cows each day, they become acquainted and understand each other with improved results. Insist that the milkers never strike a cow. The temperament of the animal creation differs just the same as in the human family, and must be studied. If a cow is nervous or ill and inclined to kick the pail over, a beating cannot improve her. It takes but a few moments to strap her legs together; she will become used to it and learn never to move while in that position. Notice particularly that the cows are milked clean. Very often a valuable animal loses her flow of milk in a little while on account of a portion of milk being left in her udder each milking. It would be prolonging this article far beyond the limit of your patience to attempt a discourse on the care of milk or butter making. It will be sufficient to say that whatever you undertake in the dairy business, persevere at it until your products are equal to any in the market and you are bound to make it pay. Don't think you know better than your customers what is good; listen to their complaints and determine they are the ones to be suited.

If something is wrong, commence right at the cow and follow the milk and its productions until they reach the consumer, and keep at it until you discover the trouble and correct it. Remember, in dairying, as in every other business, that true merit and worth will eventually succeed.

The essay having been declared open for discussion:

JOHN I. CARTER of Chester county. I was somewhat surprised, in coming up here, to find this section of the State so well adapted to grass and to see such excellent grass land; but I was also surprised in

this connection that I saw so few cows. With us the two, in Chester county, would naturally go together; good grass and cows go together with us as naturally as can be and seem inseparable. Another thing which somewhat surprised me was the almost entire absence of corn and wheat; it is true that we saw limited amounts of both, but no large fields of either. It is true that you are probably too far north and at too great an elevation to grow our southern corn, but I saw no extensive fields of this crop. The absence of wheat with us would mean the absence of litter for our stock, and that means dirty stables and small manure piles.

A successful dairy must be a winter dairy, and that means plenty of litter. Possibly you substitute oat straw for wheat. In our section of the State every fourth or fifth field is in with corn, wheat or oats. You have a splendid grass country, and it seems to be natural grass, too; it seems to grow spontaneously, for along the railroad I saw clover and timothy where it is not at all likely either were sown. Your streams are pure and clear, and you certainly have a healthy climate. It seems to me that you have everything to encourage you to go into dairying extensively, and that you have all of the necessary items to the production of good butter. I did not see as many cows as I expected.

R. S. SEARLE, of Susquehanna. The gentleman did not pass through the heart of the dairy district of our county. Had he gone on through the county to the New York line he would have seen more cows and better ones. We have cows enough, but we do not care for them properly. We do not feed them and obtain the best possible results from them. We have as practical dairymen here as in other sections of the State, and most of them do comparatively well, but they do not force their cows as they do in the southern counties of the State. They do not feed as heavy and do not get as good results. They must feed higher and better. At our recent institute a farmer from Brooklyn township, told us how he had accomplished astonishing results by buying feed and by a system of high feeding. He purchased grain for his cows, warmed the water which they drank, steamed the hay, fodder and meal, and gave them more or less cut straw with their meal. We have cows enough and we work hard enough. It is true that we do not have large wheat fields, but that is not the fault of the land, for good wheat can be produced here. We produce large amounts of sowed corn for fodder, and I think one of our young farmers now present now has twenty acres of it. Mr. Ball is an excellent dairyman. He has brought his dairy up to nearly two hundred and fifty pounds per cow on an average, and this is doing well. He makes first-class butter and gets first-class prices for it. This shows that what one man has done another may do.

Question. Will butter made from cream separated by centrifugal process keep as long and make as good butter as that separated in the old way?

R. S. SEARLE of Susquehanna. Mr. Ball has been carefully experimenting in order to obtain a satisfactory answer to this question, and the result of his experiment is that, other things being the same, there is no difference in the keeping qualities of the butter.

H. H. COLVIN of Lackawanna. I have come to the conclusion that the butter made by the new process will not keep hard and solid as long as that made by the old plan, but I sell for immediate use and my customers do not care much about its keeping qualities. I have

for a number of years past been raising the cream in what is known as a Cooley creamer and it answers very well and is convenient. I think that they can raise wheat here but Mr. Searle tells us that it is not a sure crop. In our county (Lackawanna) we have natural grass land, very much as you have here, and we are classed as a dairy county, though I think it probable that Susquehanna has the reputation of being the largest butter county in North-Eastern Pennsylvania. In our part of the State many sell milk, and those who follow this practice do quite as well as those who make butter. It would be an excellent thing if this Board could in some way ascertain the proper average production of our cows. It would be of great help to dairy farmers and would enable them to know whether their cows are doing well or not. Many are keeping cows which do not yield them forty dollars per year. Many could, by proper selection and management, do twice as well off the same land and with the same number of cows. If they could in some way ascertain which were paying and which were not, they could do much better. I have kept a strict account of my milk and my experience was that a dairy of from twenty to twenty-five cows would give me three thousand quarts, or say six thousand pounds, of milk, and that this was as good as the average dairy will do; and yet many have reported much more than that. As has already been said, "what one can do another may also imitate."

R. S. SEARLE of Susquehanna. A few years ago we produced a surplus of wheat in this county and there is lots of it in the county now; I have raised two years in succession, and one year had twenty-eight bushels of spring wheat to the acre. Our farms are too large and we would be better off with less land.

A GENTLEMAN. In our part of the county the land seems too heavy for wheat. I have raised thirty-six bushels per acre, but we lose about two crops out of three, and if I do that even thirty-six bushels per acre will not pay me.

J. G. ZERR of Berks. One of the essayists states that cows should have pure and clean water to drink, but I often find my cows of a different opinion, and I find that, although they have good, pure and clean running water, they will sometimes drink from puddles along the lane as I drive them up to the barn. This they do after just having crossed pure running water.

A GENTLEMAN. We started a creamery in our part of the county about the middle of June and for a time seemed to get along very well. It was on the cream gathering system. After a time we got a test churn and since then things have not moved as smoothly with us. I would like to ask if anyone present has had any experience with the test churns, and if so what the result was?

JOHN I. CARTER of Chester county. A gentleman has asked for the name of the best kind of churn. Our dairymen use a number of kinds, but the most popular one is the square churn with no dash. It can be made strong and with a large opening for taking out the butter, and in this respect is probably better than the round churn. The larger churns used in our section are round and with a stationary dash fastened to the sides; the whole churn revolves. With one of these we can churn from two hundred to three hundred pounds of butter; they have a slight tendency to break the grain and to make the butter difficult to wash and get the buttermilk out. You cannot go far amiss in buying either a square churn or a round one with stationary dash; the former is the most readily cleaned.

As to the keeping quality of butter made by the old and the new (centrifugal) process, I would say that I find no great difference in its keeping qualities, but there is this about the centrifugal separation of cream: When we come to use the centrifugal machine we get the milk from thirty, forty or fifty different dairies, some of them not very careful, and it is absolutely necessary that we shall handle the milk as rapidly as possible so as to get the butter away from the impure material as soon as possible. This is one of the great advantages of the centrifugal; the butter or cream does not remain long in contact with the impure material in the milk. Now if we were to divide the milk as it comes from the cow into two parts and run one through our centrifugal and set the other away to raise its cream by the old process you will find that one lot of butter will keep just as well as the other, the only advantage being the one to which I have just directed your attention. Before we got the centrifugal we set our milk in large, deep tanks. Our centrifugal butter brings better prices than when made by the old process.

We have a large creamery association in our neighborhood which embraces some twenty-five creameries, and at our meetings we exhibit samples of our products. They are quite rapidly approaching each other in quality and are all much nearer alike than at first. When we first commenced some were obtaining ten cents more per pound than others; now all make about the same quality of butter and get about the same prices.

R. S. SEARLE. Do you not find that you get more butter by the centrifugal process?

JOHN I. CARTER. Certainly we do, and at the same time we run much less risk of injuring the cream by its taking up bad odors either from the milk or from surrounding objects.

DISCUSSION ON DAIRY MATTERS AT MONTROSE INSTITUTE.

Mr. HOLLISTER, Montrose, Pa. If the milk sets in a cool place, and you skim before souring, the cream will usually raise in twelve hours, but would rather let it stand a little longer; forty-five degrees is cool enough; in my opinion some use too much ice; butter will more easily melt down where too much ice is used, it is better to use cold spring water. [If butter made with ice, butter made in a spring house, and butter made in a good vault, are exposed to the same degree of heat, that made with ice will melt down first; next that from the spring house, and lastly that from a vault.—SECRETARY.]

In the creamery we used vats, on the farm we have used small and large pans; my covered pail has a funnel in the top covered with a cloth, and I milk on the cloth.

J. D. BAKER. During the year 1886 we paid the creamery company here (Montrose) twenty-six and one-half of milk for the price of a pound of butter. They were given the highest average quotations of creamery butter, less three cents per pound for making, and the average amount we received for the eight months was twenty-one and one-tenth cents per pound; how much this amounted to per cow I did not estimate. That was the whole milk delivered at the creamery. We had to give five cents per can for the skim milk that we took back with us.

Mr. BARDSLEY, Wyoming county. I furnish milk to a creamery in your county, and feel, really, like one of you. We furnish milk to a creamery which uses a centrifugal; we get the price of a pound of first-class dairy butter for twenty-six and one-half pounds of milk furnished; I paid one cent per pound for making; I have not got the exact figures but we have got about twenty-one cents for our butter up to last November. I then took my milk out; others continued on for one dollar and twenty cents per hundred pounds; my cows have netted thirty-seven dollars per cow; I do not manage as closely as some of my neighbors do; some get forty dollars per cow and some as high as forty-two dollars per head. We believe we pay the company too much, and that it does not take twenty-six and one-half pounds of milk to make one pound of butter; we think it will require but twenty-four pounds, on an average, the whole year; we will make an effort to get the creamery to allow us at the rate of twenty-five pounds of milk for one of butter, or we will seek some other market for our milk. I would like to have the sense of this meeting as to whether it requires twenty-six and one-half pounds of milk to make one pound of butter.

Mr. PORTER stated that during the year 1886 his fourteen cows had averaged him twenty-one pounds of milk to one of butter for the whole season.

S. W. LESTER, of Troy, stated that the amount of milk required to make a pound of butter would vary with the breed, the feed, and the treatment at the creamery; and that the amount actually needed varied all the way from fifteen and one-fourth to twenty-four and one-half pounds, and the returns per cow from thirty-seven dollars and thirty-seven cents to fifty dollars and thirty cents per cow.

In answer to questions, Mr. Lester stated that he had used different cans and processes side by side, and preferred the plan of submerging the milk and getting it away from the action of the atmosphere; that the can and cover should be so made that the animal heat in the milk can be first given off, and so that it is not confined in the milk to its injury; that the reason he had adopted his present system, was that he found that it was putting money into his pocket, and that, therefore, he was not disposed to try any other. He stated that there was a demand for unsalted butter; that butter properly made will keep better without salt than will the over-salted butter; that he had shipped ten car loads of unsalted butter that went to Glasgow and London, foreign markets, to parties he specially contracted with, and that some of this butter was kept for fourteen months before it was used. When the price of creamery butter goes down, in August, he leaves it with his patrons to say whether he shall ship as usual, or hold awhile for better prices.

J. E. CARMALT liked the idea of holding on for better prices, and thought it would be a great improvement if our American Dairy Company had an arrangement by which this could be done. He had used the Ferguson creamery, with a closed case, with a glass front; that it was a theory that the sunlight had much to do with the coloring of the butter; that butter would keep better in large than in small packages; that salted butter would keep the best, and that for long keeping it should be more heavily salted; he put one milking into each pan, and had enough of them to hold three milkings; much of the profit depended in feeding the skim milk on the farm; if a little cream is left in the milk it would do the calves and pigs no harm.

S. W. LESTER, Troy. We established a creamery in 1882; we have it under what is known as the cream-gathering plan, and have used the submerging process of setting milk. When we began in 1882, the cream-gathering process was new in the country, and many stood aloof. We have no contracts with patrons except verbal ones. We say to them, we will do your work for you so and so. I make these explanations so that you will see the cause of discrepancies that may appear during this convention.

During 1882 we had the product of about seven hundred and fifty cows. We don't compel them to furnish a certain amount or a certain number of cows. We pay for the cream for the amount of butter it will make, within four cents.

From the first of June to the last of July is the heaviest flow of milk. We found it took twenty-three pounds of milk, for the season of eight months, for one pound of butter. In 1883 we had in the neighborhood of eleven hundred cows, and it took twenty-one pounds of milk. We got the farmers and their wives together and endeavored to educate them to what was for their best interest in managing their dairies, &c. By changing cows we found we could reduce the quantity of milk required to make a pound of butter. During 1884 fourteen hundred cows represented the dairies. During 1885 twenty and one-half pounds of milk made a pound of butter. I would like those who are using the centrifugal process to bring those matters to the front, as I am aware that I have come to learn. Our experiences we know are various; the results are as various as the defects under which we are working. I stand at your disposal, and will answer with all fairness, and give my experience to back them up. I would like to have these other parties to come to the front, that we may profit by this institute, and also individual dairymen.

A. O. WARREN, Montrose, Pa. I have a small dairy and the rehearsal of the little red cow reminds me of mine, but she is a brindle; she came in fresh last fall and for the last forty-five days we have realized twenty-one dollars from her, and we used what we wanted; during four weeks we made eighteen pounds of butter and used milk four times a week for supper; what her pedigree may be I cannot tell; she has plenty of good sweet hay and pure water; since cold weather has come on I feed her a pail full of roots with a pint of cornmeal and some warm slop; she has this at every milking.

FRANK CARTER, Auburn. In order to show my method of farming and the progress over the old way, I will go back and give three years' experience, or, all the experience I have had on my own responsibility. And in order to be distinctly understood, before I make these statements, I will say that my farm is the tail end of two farms; that for twelve years, before I had it, everything was taken off to the main part of the other farm and nothing put back. Please bear that in mind.

I have but seventy acres of cleared land. The first of April, 1884, I commenced farming. I put on twelve cows, made 1,800 pounds of butter and sold it at twenty cents a pound; total, $360. Veals and calves raised, seventy-two dollars. Pork sold, fifty dollars. Potatoes, seventy-five dollars. Bought eight cows the first of November and wintered, cost $125. Total receipts off the farm for 1884, $672.

First of April, 1885. Eighteen cows, three yearlings. Made from eighteen cows this year 3,600 pounds of butter and sold it at twenty-five cents per pound, or $900. Pork sold, $100. Veals and calves

raised, $140. Poultry and eggs, thirty dollars. Total, $1,170. I commenced farming the first of April and my contracts are for the first of April.

First of April, 1886. Furnished with twenty-four cows. Have made this year, or will by the first of April, 5,500 pounds of butter, or 229 pounds per cow; sold it at twenty-five cents per pound, or for $1,375. Calves sold, $125. Pork raised, ten dollars. Poultry, thirty dollars. Apples, thirty dollars. Total for 1886, $1,510. This is all from the cows. Grain fed for the year, $300 worth, or twelve dollars and fifty cents per cow. Taken from total receipts of the cows, leaves $1,210 or fifty dollars and forty-four cents per cow clear.

I usually churn by wind power. I can churn twenty-five pounds of butter and salt it in thirty minutes. I work the butter twice. I intend to ship it as soon as made, once a week. I pack in Bartlett's patent boxes, three, five and ten pound packages. I have a constant market for my butter, never tried its keeping qualities. Last summer I held some of my June butter some three or four months.

Last year I had twenty acres of corn fodder, planted in drills, in rows; I go through it many times with cultivator. I hire one man.

W. Sterling, Brooklyn, Pa. I believe that just as much milk can be made from November first to May first as from May first to November first. I don't pretend that a cow will yield as large a quantity of milk on hay and grain as in flush pasture. A cow that will yield twenty-four pounds of milk in November, will yield in May twenty-eight pounds of milk. A cow coming into profit in November will give the same quantity of milk clear through the fresh feed of summer. I believe this to be one of the strongest arguments in favor of a cow's beginning her work in the fall. A cow milked through the winter will pay from three to five dollars per month during the summer; while the cow milked through the summer will scarcely more than pay her feed after the middle of November. As to commercial fertilizers, I would rather have wagon loads manufactured on the farm than to have thimblefulls manufactured away, which we pay dearly for.

I have no better facilities for making winter milk than farmers in general; a cold stable, ice water, no steamed feed. I get, perhaps, sixty-two dollars per cow. The cost of grain ten or twelve dollars; that is, the average for the whole lot, only about two-thirds of them being winter milkers. I believe it is a mistake to deacon calves when the prices are high. I am now feeding five heifer calves, and they are doing finely. Coming in the fall, the calves have one winter of dry feed and two summers of green pasture, which is better, I think, than one summer of green feed and two winters of dry feed.

F. H. Holister, Montrose. Without pure milk and cream, no good butter can be made. The dairy should have comfortable, well-ventilated stables, and plenty of good, early cut hay and other nutritious food; also an abundance of pure water. The milking should be done with the utmost care. I would recommend the covered milk pail which has a portion of the top covered with a cloth strainer, to milk in, thus preventing straw, specks, etc., falling into the milk. Set the milk in a cool place, not cold enough to freeze; as soon as the cream all rises, skim, warm it to seventy degrees, keep it warm, and when thick, churn. We have used the Blanchard churn, and consider it the best in use. Churn with cream at sixty-two degrees in summer, and sixty-four degrees in winter. Churn at a lively motion, not too fast. When the cream begins to separate, remove the cover and rinse off the cream adhering

to the sides and cover. If the cream is a little cool, and the butter fine and crumbly, use tepid water. Check the motion a little to finish; carefully avoid churning too much. When the butter is granulated, say the size of peas, draw off the buttermilk, run in cold water to cover the butter, and wash in the churn. After it is thoroughly cooled, draw off the milky water, then run in more water; then remove it to the butter worker, using a fine sieve made for the purpose, leaving it to drain for a short time; then sift on the desired amount of salt, work it through and cover with a cloth wet in brine to exclude the air and keep out speck. Let stand two hours or more to remove the brine. When worked nearly enough, throw on a sprinkling of well-sifted salt and work it through. Then it is ready to pack. I consider it one of the best indications of fine butter if the clear brine follows the knife while cutting.

FRUIT AND FRUIT CULTURE.

SMALL FRUITS.

By E. L. WESTON, *Brooklyn, Pa.*

The field cultivation of small fruits for market is a branch of horticulture of comparatively recent development.

Marshall P. Wilder says that when he went to Boston, sixty years ago, there were few fruits brought to market except apples.

Twenty-five years ago the raising of small fruits on a large scale was only attempted near the large cities, and it would have been a hard matter to have found even a half acre in small fruits in Susquehanna county.

Downing, in 1857, mentions as standard varieties of strawberries, Crimson Cone, Hovey's Seedling, Longworth's Prolific, and Wilson's Albany as a promising new variety. He mentions no distinct varieties of Black Caps, and puts the Antwerps, Franconia and Orange as the best of the red and yellow raspberries. Most of these are now forgotten, and the rest are only mentioned as the best of the old varieties.

When my father first began cultivating small fruits, the crop was marketed in the village of Brooklyn; one bushel per week was a large sale. Now, with the population only double, one bushel per day will not meet the demand. New methods of cultivation and new varieties are to be tried; new markets and better methods of marketing are to be sought by the successful small fruit grower.

While it would be tedious to mention all the different methods and varieties found worthy by many growers, I will give briefly such as have proven the most successful with us. The *strawberry* naturally comes first in season, if not in importance, of all the small fruits.

While it does fairly well on all soils, the best results are obtained from a rich, moist loam. The ground should have been used in some hoed crop, at least one and better two years preceding the strawberries; a heavy manuring for corn, followed by potatoes, leaves the ground in good condition. If sod ground is used, the white grub will destroy a large portion of the vines.

The ground should be as mellow as it can be made by good plowing and thorough harrowing. Furrow for rows four feet apart, plants one

and a half to two feet in row. Plants should be new and from a bed that has never borne, with roots of a light brown color.

For spring planting, first to fifteenth of May, the roots may be trimmed to two and a half inches in length, and all the leaves, excepting one or two new ones, and all the blossom stems cut from the top. While setting keep the plants in a pail partly filled with water so that when placed in the ground the soil will stick to the roots.

Make a small mound in the bottom of the furrow, spread the roots over this and press the soil firmly over them so that the crown of the plant will be a little above the surface of the ground. On ground that is not too stony a line may be used to mark the rows and a spade to set plants; thrust the spade into the ground and push the handle from you making a narrow opening; spread the roots of the plant in this, withdraw the spade and pack the soil thus left above the roots by treading with the foot. Clean cultivation is most essential to insure success. By clean cultivation is not meant keeping a field so that one can see more strawberry plants than weeds, but keeping it so that no weeds can be seen. The time to kill weeds is before they get out of the ground. To those who have seen our patch of berries in the busy part of the season, I need only say that theory should always be better than practice. The soil should be stirred every week till midsummer, to kill weeds and induce a vigorous growth of plants

In cultivating with a horse fewer runners are destroyed by always going the same way between rows, that is out in first space and back in second, and so on.

Allow the plants to make all the runners they will, only leaving a space one and a half feet wide between the rows to be used as a walk when the berries are picked.

Some kind of mulch is essential to prevent thawing and freezing in winter and spring, and to keep the berries from coming in contact with the ground. Straw, leaves, if they can be kept in place, corn stalks, evergreen boughs—all are good—strawy manure is best. We use, because we have it, horse manure from stables where sawdust is used for bedding, applied at the rate of thirty loads per acre in the fall after the ground is frozen.

Unless very weedy, it is not necessary to cultivate in the spring, and in no case should the vines be disturbed after fruit has set.

What should be done to an old bed? Plow it up as soon as the berries are off; it is easier to set out a new bed than to properly clean out an old one.

There are four natural species of wild strawberries. According to Chambers, they are all native of America except the first. 1. Common strawberry, which includes Alpine and Perpetual of Europe, and our common wood strawberries. 2. Virginia wild strawberry, sometimes called Virginia Scarlet, our common wild field berry. A variety of this is found from Western New York west is the supposed origin of Hovey's Seedling, our first large strawberry. 3. Hautbois strawberry—dull reddish in color and musky scented. 4. Chili strawberry, native of the Pacific coast. Pine strawberry, a variety of the Chili, according to A. S. Fuller, is distinguished by large, showy, pure white blossoms, high fruit stems, and large, irregular, coarse-grained fruit.

Our cultivated varieties are improved hybrids of these, the larger proportion of them being hybrids of Virginia Scarlet and Pine strawberries. Varieties that contain a large proportion of Pine blood, as Sharpless, Ironclad and Vick, are tenderer and less able to withstand

spring frosts than are varieties that approach nearer the Virginia Scarlet type, like Crescent and Manchester.

Strawberries are divided by form of blossom into two classes—perfect flowered and pistilate varieties. To insure perfect fertilization, each field should contain one-fourth of perfect flowered varieties, and care should be taken to have the season of blossoming the same.

The best varieties—hardiness, productiveness and quality considered—are Crescent, Miner, Manchester, Kirkwood and Sharpless. Other varieties, not quite as productive, but better in some other respects, are Jersey Queen, Seneca Queen, Golden Defiance, Primo and Sucker State. The ideal strawberry has not been discovered yet. The above all have defects. The Crescent is like the Burbank potato, on some soils and in some seasons it is poor, but when everything is favorable it is immense.

The foliage of Manchester is inclined to burn; Kirkwood has the musky flavor of the Hautbois, too strong to please many; Sharpless has a bad habit in wet seasons of rotting before it is ripe, and is notional as to soil, doing best only on heavy loam.

The raspberry, like the strawberry, does fairly well on all soils, but large crops and large berries are only obtained on deep moist loam.

The same preparation of ground as for strawberries is necessary; it should be richer for best results.

While wild varieties grow spontaneously in newly cleared and waste land, the cultivated varieties are only productive on well cultivated ground, and it is waste of time to set them in neglected fence corners to economize land.

Furrow for rows at least six feet for Black Caps and five for red varieties. Transplant the same way as is first given for strawberries.

In transplanting Black Caps, care should be taken that the buds from which the tops grow are not broken.

Our experience has been that transplanting can be done with least liability to injure buds after they have grown a few inches above the ground.

Clean cultivation for both black and red raspberries the first season. Afterward the Black Caps may be mulched and manured and they will give fair crops for five or six years. If not mulched, two or three crops are all that is profitable, then they should be plowed up and their place supplied by a new planting.

The new growth of Black Caps should be pinched back when the canes are about two feet high, to keep the bushes compact and obviate staking.

Red raspberries are much more persistent than Black Caps and a planting will last eight or ten years if well cared for.

The suckering varieties should be hoed each season till the berries begin to ripen and the suckers treated as weeds—varieties like Shaffer, that do not sucker, may be mulched the same as Black Caps.

They should be top dressed each fall with well-rotted manure or wood ashes. A light application of salt is good.

As the canes grow in one season and bear the next, the bearing canes should be cut out soon after the fruit is off or early the next spring. The canes that are to bear should be cut back each spring to vigorous, well-ripened wood.

The Black Caps are propagated from layers. To get a large number of plants nature needs a little assistance.

The last of August or the first of September the tips of the canes

that have grown that season should be covered with soil when a large proportion will take root, the terminal bud forming a new plant.

A garden trowel is the handiest tool for this work, and a much larger per cent. will root if the tips are put straight down into the ground.

The red and yellow varieties, excepting Shaffer, increase by suckers. All our cultivated varieties come from three natural species: American black raspberry, European garden raspberry, and Wild Red raspberry.

These have been hybridized, but not so much as strawberries. The best varieties of Black Caps are Gregg, late, very late; Nemaha, a promising, new, late variety, said to be hardier than Gregg; Sowhigan and Tyler, early. The best yellow varieties are Golden Queen, a very promising new variety, resembles Cuthbert in all but color; Carolina, a hybrid of a Black Cap, and Brinkle's Orange, which propagates both from tips and suckers. The best red varieties are Brandywine, early; Cuthbert, late; Shaffer, late, a hybrid of Black Cap and the garden raspberry. It propagates from tips only; the most productive of all the raspberries. The past season it yielded for us fifteen bushels from fourteen square rods of ground.

The blackberry requires nearly the same treatment as the red raspberry; being a more rampant grower it requires more room. There are too many wild blackberries and the cultivated varieties are too tender and uncertain crossers to make the cultivation of the blackberry for market profitable here. The most hardy kinds, like Snyder and Taylor, are frozen back, unless the winters are very mild. If the canes are bent down and covered each fall a fair crop may be expected even from tender varieties, like Kittatinny and Lawton.

The Lucretia dewberry, recently introduced, appears to be an improvement in the right direction. Its trailing habit of growth makes it easy to protect.

The currant and gooseberry do best on rich clay loam. In planting, make rows six to seven feet apart, plants three to four feet apart in rows. Use well-rooted two-year-old plants. Clean cultivation should be given, and after two or three years some kind of mulch should be used through the bearing season.

Two things most essential to the production of large fruit in abundance are heavy manuring and annual pruning. The currant is the hardiest, most reliable crosser, and the most neglected and abused of all the small fruits. It is a quite common practice to give currants the margin of the vegetable garden and leave them to fight with weeds and grass. In such places they come as near being profitable as a patch of corn would under the same conditions.

The currant and gooseberry bear their fruit on wood two or more years old. In pruning, cut out each year the oldest and most enfeebled wood, and all but the thriftiest new shoots or suckers that start near the ground, thus producing a succession of new bearing wood. The currant and gooseberry are propagated from cuttings; for these use new wood taken from the bushes in the fall, and cut into six to eight-inch lengths. Cut out the buds from lower half of cuttings, set in a trench, and cover just before winter with some coarse mulch; remove the mulch in the spring and keep well hoed.

The best variety of gooseberry are Houghton and Downing. The most common varieties of currant are the Red and White Dutch. The best are White Grape, Victoria—a very late red variety—and either

Cherry, Versaillaise or Fay's, the three are so nearly identical, one is as good as either of the others. If black currants are liked, Lee's Prolific and Naples are good.

The grape has a history as old as that of the human race. It is one of the first fruits mentioned in the Bible: "And Noah began to be a husbandmen, and he planted a vineyard." The spies who visited the promised land, returned with a bunch of grapes so large that it was carried on a staff between two men. While our soil, climate and time will not give us bunches as large and delicious, we can, at least, grow enough for home use.

The natural advantages of this part of our country are not such as make the cultivation of grapes for outside markets profitable; and the following remarks are suggested only from experience in growing them for home use:

The soil should be dry and warm; the location sunny. Shaly, gravelly and stony soils are best.

We have vines growing in ground so stony that in setting it was necessary to import dirt to properly cover the roots. The crop is not quite as large as from vines on heavy loam, but the quality is superior and the season of ripening at least two weeks earlier. In all the large grape-growing regions of New York State the land is drift and gray shale, containing a large proportion of disintegrated limestone.

Too much stable manure is not good, as it produces too rank a growth of not always fruitful wood. Wood ashes, ground bone and lime are good. Waste bone may be utilized by packing them in a barrel with moist ashes and keeping them till the bones are softened.

On most farms there is room for all the vines necessary on the sunny sides of buildings, along walls, by large rocks, and other odd places. If a piece of ground is used wholly to grapes, the rows should be ten feet apart, vines twelve feet apart in row for rank growing kinds like Concord and Agawam, and eight feet for slow, small growing kinds like Delaware and Lady.

Thorough cultivation should be given each season till the middle of August. Cultivating late in summer induces a growth of wood that cannot ripen.

The grape is propagated from layers and cuttings. Layering is the most certain, but not the most rapid method. A cane of the previous season's growth is covered in a trench, about five inches deep, when the buds begin to grow in the spring. It will root along its entire length, and each bud will send up a shoot. These plants may be taken up, cut apart and transplanted the next fall.

After midsummer, a shoot of the same season's growth may be used to make single plants by covering a portion with soil, leaving the end uncovered to form the top.

In propagating from cuttings, use only well-ripened wood taken from the vine before freezing weather in the fall. Cuttings should be six to eight inches in length, with at least two buds. Tie and lable in convenient bunches, taking pains to have the butts even. Bury the branches, tops down, where the water will not collect around them. Cover with eight or ten inches of soil; place some kind of litter over this to prevent freezing. In the spring, after the frost is out of the ground, remove the litter and soil, except about four inches, leaving them this way till the buds start.

Make the trench in which the cuttings are to be set, a foot wide and eight inches deep, and put two or three inches of road sand in the

bottom. Begin at one end of the trench and place the cuttings in a slanting position in ranks, five or six in each rank, so that the top bud of each cutting will be even with the surface of the ground when the trench is filled. Use road sand instead of soil to fill around the cuttings, taking pains to pack it firmly about them. Mulch with fine manure; shackle with boards for three or four weeks and ninety per cent. will grow.

In training and pruning the grape three things are to be remembered:

First. That to obtain fruit in perfection the vines must be kept in mall compass.

Second. That the most vigorous growth is from the top or end buds of any cane.

Third. That no fruit is borne on shoots from old wood.

The best time to prune is in the fall, soon after the leaves drop.

When a vine is transplanted it should be cut back to two or three buds. The first season let only the most vigorous shoot grow, rubbing off all others. Cut this back to a foot in height.

The second season let two shoots grow; cut each of these back to four or five feet in length; these are to form the arms.

With weak, slow-growing kinds it will be necessary to cut back again to two or three buds and make the arms the next season.

The third season a trellis will be needed, this should be five feet high with five horizontal slats of wires. Fasten the arms to the lower wire so that the middle of each arm shall bow upward to compel an equal development of all the buds. The shoots that will grow from the arms should be fastened to the trellis in a vertical position; they may be permitted to bear one cluster each the first season.

Short-jointed varieties should have every other one of the buds on the arms rubbed off. All the pruning necessary after the third season is to lengthen the arms to cover the trellis; cut back each fall the upright shoots, only leaving one or two buds next the arm, and every five or six years cutting out the old arms and forming new ones from shoots that start near the main stem. This is a slight modification of what is called the Fuller method of pruning. The Kniffin method is used more when grapes are grown on a large scale. This requires a trellis with only two wires, the lower one three feet from the ground and the other five feet from the ground.

The first season let one shoot grow, cutting back to the height of the lower wire. The second season let three shoots grow, one each way along the wire, and one to the upper wire, cutting back the side shoots to two buds and the central one to height of the upper wire. The third season let one shoot grow each way along each wire, cutting back each shoot to six or eight buds. Each season after this cut out these old shoots or arms and use new shoots that start next the main stem to form the arms.

If the vines are properly pruned each fall by either method all summer pruning may be done with the thumb and finger; pinch out the ends of all shoots after they have grown a few inches above the top of the trellis; with the Kniffin method when they have made two or three leaves beyond the last cluster of fruit. Remove all suckers and unfruitful shoots that are not needed to grow shoots from another year, and pinch out all laterals after they have made one leaf.

Our cultivated grapes are improved varieties and hybrids of four natural species:

First. The European Wine grape. This is too tender for our latitude.

Second. The Northern Fox grape. From this we have Concord, Worden, Moore's Early, Telegraph, Niagara, Carlotta and Victoria. The Roger's grapes, Agawam, Salem, Wilder, Barry and Lindley are hybrids of this and the European grape.

Third. Summer grape. From this we have only one first-class variety, Eumlau.

Fourth. Winter or Frost grapes. We have one hybrid of this and the Fox grape, Delaware.

The following are among the best:

Black varieties, earliest—Emelau, Telegraph and Janesville.

Later and better—Worden, Wilder, Barry, Concord and Moore's Early.

Red varieties—Vergennes, Brighton, Lindley, Salem and Agawam.

White and green varieties—Carlotta, Lady, Martha and Niagara.

The best and most profitable way to market small fruits is the same as for all crops, to sell directly to the consumer.

Such markets can only be found and held by a first-class article; make gilt-edged fruit as well as gilt-edged butter.

Whether the fruit is to be sold directly to consumers or through the commission trade the packages should be neat and attractive and the fruit well sorted.

A box filled in part with small, inferior and over ripe berries is no more likely to sell for the highest price than is a barrel of apples filled with everything that comes from the tree.

Is raising small fruits profitable? is often asked. Yes, just as profitable as any other farm crop and no more. The principal advantage is that a larger business can be done on a smaller amount of land than with most other crops.

There is as yet no over production of good fruit, but there is under consumption and faulty distribution.

L. Lindley & Co., of Scranton, are authority for the statement that the receipts of strawberries in Scranton, Saturday, the 19th of June last, were eight hundred bushels.

Our production, hardly! These supplied the market two days. This would give each of the fifty thousand people in Scranton one-half pint per day.

The system that makes the consumer pay ten cents per quart for strawberries, while the producer only receives five cents; the system by which those who handle the farmer's produce take their profit first and leave the farmer to be content with what is left, needs some vigorous pruning. While all are not so situated as to make small fruit growing for market expedient or profitable, every person that has land should raise enough for home use. A fruit garden should be as much of a necessity as a vegetable garden. Few farmers raise any fruit but apples; this is in part due to a mistaken idea as to the amount of time and work required, and in part to heedlessness. The same methods that make cultivation of small fruits in large fields successful will make the fruit garden a success. Select ground where the cultivating need not all be done by hand, and the time and work required will be small in comparison with the added health and pleasure derived.

SOME REQUIREMENTS IN FRUIT CULTURE.

By J. A. HERR, *member from Clinton county, Cedar Springs, Pa.*

Among all people, in all climes where fruit can be grown, it forms a prominent and healthful portion of human diet. In the heated portions of the earth, it forms the principal food of the natives. Growing spontaneously, as it does over a great portion of the earth, it invites to indolence and sloth, while reposing beneath its foliage, and subsisting on its gratuitous productions. These facts, perhaps, will, in some measure, excuse the very prevalent idea, entertained by a great majority of our people, that fruit, even in this climate and locality, is a sort of spontaneous production, requiring but little except the planting to realize the luscious fruits with which our markets are supplied, affording a sufficient excuse for the marauder to help himself to whatever comes within his reach.

Fruit is looked upon as a gratuity to man from the "Giver of all Good," which he, in turn, should offer as a free gift to all desiring; and this idea affords sufficient excuse for the passer-by to help himself as his appetite may crave or as opportunity affords. Every school-boy feels licensed to partake of the fruit growing near the path which he travels, and a person would be considered mean who refused a mess of fruit to any one asking for the same. There is no other product of the farm that affords so much license for stealing, unless it be the "iniquitous watermelon." If the premises in this case were correct, the conclusions might justly follow.

The practical fruit grower realizes the fact that this is not the climate of spontaneous production, and that it is only by constant and repeated efforts that his labors meet with success. There is no department in agricultural pursuits requiring so much close attention, well-trained management, and diversified knowledge as the propagation, cultivation, gathering, preservation and marketing of all the different kinds of fruits suitable to be grown in one locality, each in its proper season. The fruit grower who personally manages his farm is constantly employed, and very much of his labor is of such importance that he cannot delegate it to another. This is especially the case during the marketing of his more perishable fruits.

The care and preservation of his fruits and fruit trees afford him occupation during most the entire year. This employment is remunerative or otherwise, just in proportion to the intelligent management of the business and the labor employed, provided the natural advantages of situation, soil and climate are of average quality.

The first item of importance in successful fruit growing is the study of the situation of the grower as to climate, character and quality of soil, drainage, access to fertilizers and adaption of these to the varieties of fruit grown.

The majority of our fruits thrive best in a sandy or gravelly loam soil, with a sufficient drainage to prevent water from standing any portion of the year. Plums and quinces will endure a more moist soil than other fruits. An inclination towards the south or south-west is generally desirable, but that is largely a question of locality as to climate. An easy access to fertilizers, especially to towns and cities where stable manure can be obtained in quantities at reasonable prices, is a very desirable consideration. "Feed the soil, if you would

have the soil feed you," is as applicable to fruit growing as to any department of agriculture. I am well satisfied that high manuring will pay in fruit growing as well as in growing any other product.

Thorough cultivation is a necessary requirement, but will not take the place of fertilizer to any great extent, but combined with it will produce the very best results. This is more especially the case in growing small fruit and in young orchards. After apple trees have become older, they may be left in grass, if the proper fertilization be not neglected.

Another item of primal importance is a careful study of the market to be supplied. To have fruit come in at the time when the market is glutted with fruit from a source where such fruit is a specialty, will not afford renumerative prices. By observing the proper time that fruit is in demand, the grower can vary his product so as to have either early or late varieties, as best suits the market.

He must also study the demands of the market and grow with a view to supply that demand as far as his peculiar location will allow. If pears or peaches can be grown to best advantage, he will plant more largely of them, observing, however, to keep up such a succession of fruits as will keep his force of employés regularly employed and his farm implements and equipments used with the greatest economy and advantage. This, however, may be varied to a specialty of one or two fruits, or to growing small fruits where plenty of help is obtainable at the proper time.

The successful grower must keep abreast of the times in growing the kind and quality bringing the fancy prices in the market. This, perhaps, is as much a matter of *quality*, or the grading of fruits, as in the introduction of newer varieties. The nearness of the market has much to do with the varieties of fruit grown. The grower living far from market will want fewer varieties and less perishable fruit than those who have a near market.

The average grower needs but few varieties, and those varieties such as succeed best in his immediate locality. This can only be learned by close attention to the productiveness and quality of fruits near by or in similar localities. Better have a tree which bears regularly and abundantly, if only of average quality, than another which can never be depended on to produce a crop, although of a much higher quality. Apples are largely local in their successful cropping. A variety may yield well and be of excellent quality in one neighborhood, and yet in a locality but a short distance away will fail both in yield and quality. It is folly to attempt to grow fruits when the soil and climate are unfavorable.

Other fruits are not so local in their habits as apples, and the same varieties can, with more confidence, be recommended over a greater extent of territory.

The culture of plums is deserving of increased attention. They need but to be protected from the attacks of the curculio to bear abundantly, and, as they always command a fair price, would prove remunerative. The only successful way of destroying this pest is by jarring the trees and catching them in a sheet or canvas and destroying them. This operation should commence about the time the blossoms are off and continue for two or three weeks. As it requires but a little time, and children can assist in the work, it is very inexpensive and is time profitably employed. I have been in the habit of attending to this labor just after breakfast each morning during

the season and but once a day, and have not failed in a crop since adopting this plan.

Quinces are easily propagated by planting cuttings in the spring of the year, which, in a favorable season, seldom fail to grow. They are very subject to the attack of the borer. but if these are attended to in time and destroyed, there is very little trouble in growing quinces. They always command fair prices and are deserving of more attention than they generally receive. I am in the habit of sprinkling salt about quince trees once or twice a year, as I believe to a profit, having never yet failed in a crop.

I do not desire to discourage experiments in fruit growing. Every grower should experiment to a limited extent, for by experiment old varieties are often improved and new varieties obtained. It is only by actual experiment that many valuable facts are learned. We must remember, however, that experiments are expensive and more frequently result in failure than success, and he who jumps at conclusions and tries all the "new valuable experiments" he hears of, will surely come to grief.

Give a wide berth to the tree agent, who, with handsome pictures and fine samples of fruit preserved in alcohol, urges upon you the importance of investing largely in some new, and, in your locality, untried fruit at fabulous prices. Better give your order to some adjacent nurseryman or local agent, who understands the peculiarities of your situation and will assist you in making a desirable selection, and at the same time guarantee to the quality of the stock.

The importance of planting good healthy stock cannot easily be over-estimated. We generally get better results by planting trees and vines that are quite young than in planting those which are older, as young trees do not suffer as much in shipment, nor in digging, as older trees. The effect is also more noticeable in transplanting trees in different kinds of soil from that in which they were originally grown. A tree transplanted from a very rich soil into a comparatively poor soil is very apt to become stunted and permanently injured.

In the propagation of fruits, either in the nursey or in the orchard, by top grafting, great care should be exercised in selecting scions that are healthy and thrifty, and from trees that bear the choicest fruit of the variety selected; as the same variety in a different locality may have inferior fruit, and by an injudicious selection of buds, an inferior fruit may be propagated.

Every fruit grower should keep a correct map of each of his orchards —memory cannot be trusted to retain all the items of information recorded in a map. Information thus recorded will be of service to all interested, and can be transmitted from one to another with all the data of the transaction. Perhaps two maps might be still better; one a temporary one in which might be noted the constant changes taking place in the orchard at the time, giving all the data of experiments; the other to contain the names of varieties and locality after tests and experiments have been made. The maps will be valuable to the whole neighborhood having access to them, as well as to future generations.

In addition to these maps, or instead of a temporary map, careful memorandum should be kept, noting the time and manner of planting, condition of soil. variety and condition of trees planted. and future treatment received. This memoranda might also contain the peculiarities of growth and habits of trees, as to time of leafing, blooming,

ripening and length of keeping. A description of the fruit as to color, size, flavor, shape and quality would also be very valuable, and would at once enable the grower to detect errors in the names of varieties planted, and save himself and others from future errors and mortifications over disappointments once endured.

Fruit growing is a life work, and the earlier in life one engages in it the greater are his chances of success. To be successful, a person should have an enthusiasm for the work, and then the longer we are engaged the more we are interested in it. Thence the necessity of enlisting the young in this most interesting and delightful occupation.

Naturally attractive, by virtue of the luscious fruits which tempt the appetite and the unfolding of the flowers and leaf in their season, the development of which is an object of interest to all, the youth of our farms might easily be induced to interest themselves in the planting and care of fruit trees and vines. They should early be instructed in the propagation of trees, and if given a pecuniary interest in the business, and given access to works on the varieties of fruits and their culture would readily become enthusiastic workers in the business, and have time to improve, with experience, so that when they arrive at the age at which the ordinary fruit grower commences to learn, they would be experienced, and, as the possibilities of the business are unbounded, might become illustrious in their chosen vocation, useful beyond measure in their day, and leaving to posterity a wealth of information obtainable only by a life of intelligent labor.

SUCCESS AND FAILURE IN FRUIT GROWING.

By WM. H. MOON, *Morristown, Pa.*

The subject assigned to me is a very extended one and can only be treated of in a general way in the short space of time allotted, but in this brief period I hope to show that success at fruit culture is readily obtainable here in our county of Bucks and vicinity. This section of the country, situated as it is with such convenient access to the two largest cities of the Union, and in close proximity to several smaller cities and towns, all of which are consumers of fruit, should unquestionably become the fruit garden of the East. New Jersey has been styled by some the vegetable garden of New York and Philadelphia, and she has also developed great adaptability in raising small fruits.

Since grain has ceased to be a profitable crop, and the farmer has to turn his attention to butter, poultry, eggs, potatoes and such articles as require him to attend market, why should he not introduce fruit culture in connection therewith, and thus add many new opportunities of making a livelihood out of his farm than if he continued to grow wheat, corn and oats only? When our successful home orchardists tell us that their apple orchards yield on an average over one hundred dollars per acre annually, and have done so for twenty years; when vineyardists report that one hundred dollars per acre annually is hardly an average yield from their vines for fruit actually sold; that a ton per acre is less than an average yield, and that twelve dollars per ton should be the limit of expense necessary to gather and pack for market this quantity of fruit; when peach orchards prove very profitable or very unprofitable investments; when quinces are selling at eighty

cents to one dollar per basket, and are as productive as they have been in lower Bucks county for some years; when good pears are in active demand at remunerative prices; when Spanish chestnuts yield annually from eight to twenty dollars per tree of fifteen or twenty years' growth, is it wise to continue to deny that fruit culture does pay? These proofs are attainable, and it is the object of this essay to give a few suggestions as to how these results may be obtained by others who may wish to branch out into fruit raising for profit.

"If a merchant were to commence business without any knowledge of book-keeping, we should exclaim at his folly and look for disastrous consequences; or if, before studying anatomy, a man should set up as a surgical operator, we should wonder at his audacity and pity his patients." This, to a considerable extent, holds good in regard to the fruit grower. There are very many experiences that have been obtained by successful pomologists in the past that have been noted down, and are now to be found either in book form or in extracts published in our leading horticultural and agricultural journals of the day, and it is well to consult these authorities.

To succeed in fruit growing the idea must be dispelled that trees once planted will grow and thrive and take care of themselves until the time they commence to bear and become profitable. Some twenty or twenty-five years ago a gentleman living near Burlington, N. J., published a book entitled "Ten Acres Enough." In this work he portrayed in glowing terms the immense profit there was in small fruit growing, and how a comfortable living and a handsome surplus could be realized annually by settling on a tract of that size in the garden spot of the world.

So tempting was the snare that many actually purchased tracts and settled on them, but not one of them I believe ever realized a living, to say nothing of the handsome surplus. The trouble was, the book misled its readers to suppose the results were sure, that no previous experience was necessary.

Fruit culture of any kind needs care and attention to make it successful. First, the choice of a suitable location is one of no small importance. Though the theories of fruit growers may not coincide as to whether a hillside or bottom land is preferable, whether a northern or southern exposure, although we believe the majority favor the latter. But on this one point there seems to be unanimous assent, that whatever the elevation or aspect the land should be rich and fertile. Land that will yield the greatest number of bushels of grain to the acre will, in all probability, give the best return in apples, pears, peaches, grapes and small fruits. The second requisite to success is the selection of varieties, one of the most important essentials, and I would suggest a good way to attain this. Consult with those raising fruit in your immediate neighborhood, ascertain what does well for them and let this form one criterion of what to plant.

But do not stop here, or you will never know how many really valuable varieties of recent introduction there are; but be willing to try some of the newer sorts, even if it be only a tree or two of a kind of some six or eight newer varieties in an orchard of one hundred trees. They can be grafted over if they should prove undesirable or not adapted to your locality. At the present time I would name in the fruits of this class, Ben Davis, York Imperial, Red Beitingheimer, Man, Wealthy, Yellow Transparent and Nero in apples; Lawson, Rutter, Mt. Vernon and Kiefer in pears; Empire State, Niagara,

Worden and Moore's Early in grapes; and numerous others to those who wish to go more extensively into the testing business with new sorts *ad infinitum* among small fruits. For strawberries too large to eat whole, we always anchor to the Sharpless.

Of apples, the inclination in this county has been to plant very largely of the Smith's Cider, which is a native, and is unquestionably a very productive and profitable kind.

One of the most common causes in failure in fruit growing, especially in apples, comes from choosing varieties of little or no value in this latitude. Those which are very valuable winter fruit in the north and east, here ripen in the autumn, falling off the trees too early to be housed and kept for winter use. Noticeably among this class are the King of Tompkins County and Baldwin, excellent varieties, but not such as can be depended on here.

That apple trees do better when taken from about the same latitude, and will ripen nearer their proper season, is my firm belief, but I know this opinion does not coincide with the nurserymen of the North. The difference in change of locality is not nearly so marked in other fruits.

Don't be deceived in purchasing fruit trees. It will take years to discover the mistake. There are hundreds of orchards in existence in Bucks county to-day whose owners would have been far better off if they had never seen them. It is a nurseryman's duty to keep all varieties distinct and true to name, and to exercise the greatest care that they shall not become mixed. All nurserymen are presumed to be honest, but some of them evidence more presumption than honesty, when they put wax fruit into magnifying jars and impose upon your credulity in asserting that it is the fruit of nature and not the fruit of art.

The judicious selection of location, and the judicious choice of varieties, having been accomplished, two important points towards success have been made. The next is the proper planting of trees or plants, which consist not in a merely mechanical act of digging a hole and filling it up like planting a post, but requires that the roots should be properly spread out so that the soil may come in contact with all portions and no interstices be allowed to remain. A little well-rotted compost is desirable as a stimulant in tree planting.

The newly planted orchard will require more or less attention every year. Constant care should be given to discover the earliest signs of the borer, which attacks the tree near the ground, and is frequently traced by small portions of fine sawdust near the opening he has made. Remove him with a knife, or other sharp instrument, as soon as discovered. Frequent pruning is beneficial to a growing orchard to keep it in good shape. Keep your orchards and fruit grounds clear of weeds and rubbish. They help increase the borer and insect enemies.

In peach trees the most dreaded disease is the yellows. Without discussing the why or wherefore of this peculiar enemy, I would say that, within a few years, many peach growers are inclined to attribute the cause to a want of potash in the soil, and they recommend severe pruning, and an application of kainite to restore them to healthfulness. Those that I have seen that were treated in this way one year ago are looking greatly benefited. The later varieties of peaches are considered the most profitable here, as we are unable to compete with the early fruit of the South.

In conclusion, I would state that it must be borne in mind in fruit-

growing, that they who raise the best and most attractive fruit are much more certain of selling, and generally at a profit, while the indifferent grower, who allows his crops to take care of themselves, is apt to pronounce fruit culture a failure. The expense of marketing poor fruit is greater than that of good, for the one sells itself by its appearance, and the other requires to be sold. As a rule there is but rarely, if ever, a surplus of the very finest fruit in the market. In regard to fruit culture, it can be said that success is obtainable by any one who has the intelligence to inform himself, the judgment to apply this knowledge, and the energy to push whatever is undertaken to success. Otherwise the failure of any or all of these important particulars will probably bring adverse results.

The president having declared the subject matter of Mr. Moon's essay open for discussion,

Mr. HERR of Clinton. Can Mr. Moon tell us anything of the success or failure of the Russian mulberry, and the desirability of it for culcivation?

Mr. MOON of Bucks. I have not yet found any way of cultivating it, and am about ready to class it as a Russian humbug; it has never, so far as I know, borne any in this section of the country; we have had remarkable reports from the West in relation to it, but I very much fear that we will have to credit them with having been very much magnified during their passage eastward.

Mr. HERR. How about the Russian apricot?

Mr. MOON. I know nothing of it, never having grown it.

Mr. HERR. How about the Kiefer pear; what can you tell us of it?

Mr. MOON. The Kiefer pear is fruitful and ornamental; it has elegant foliage and bears beautiful looking fruit, which is very tempting; but I would advise you not to attempt to eat it until it is fully ripe. They are said to be very palatable by those who have attained the art of ripening them properly. Some say they are very nice to preserve.

A LADY. Did Mr. Moon ever hear a lady say that they were nice to preserve, and if so, will he tell us how to do it?

Mr. MOON. A pound of sugar to a pound of fruit.

Mrs. HESTON of Bucks. I think it probable that Mr. Moon has some of the trees to sell; we cannot get the pigs to eat them.

Secretary EDGE. Is it not a fact that many trees not the Kiefer have been sold for it, and that its character has been thus unfairly injured? I have found at least a half dozen entirely different pears all called Kiefer, and planted for such; some of them are frauds, but which?

Mr. MOON. The Kiefer is one of the easiest pears to grow, and one of the handsomest growing trees; I can see no reason for substituting another for it, except to make some old variety sell, and thus make money out of it. But there is no doubt that in certain localities the Kiefer does much better than in others. In the State of Michigan I saw Kiefer pears about the size of our Seckle; they tell us that it is too far north for them there; grown as far south as Philadelphia it matures fruit of a good size. A New Jersey fruit grower has assured me that he has in his cellar sixteen hundred baskets of Kiefer pears for which he had refused one dollar per basket. They were gathered from ten acres and from trees from which he has grown and is growing large quantities of small fruits for market.

Secretary EDGE. Can Mr. Moon give us any information in relation to grafting, or working the quince upon the "white thorn?"

Mr. MOON. I do not know that it has been done on the white thorn,

but have heard of it being worked upon a closely allied variety. It was tried extensively some years ago in one of the New England States; latterly I have been told that it did not prove a success; why, I do not know, but I believe that it did not produce a satisfactory and steady growth.

Secretary EDGE. Is there any difficulty in effecting a perfect union ?

Mr. MOON. They will unite temporarily, but I believe the union is not lasting, and that this is one of the reasons assigned for the failure and abandonment of the plan.

Secretary EDGE. My reason for asking the question was, that at the Bloomsburg meeting of the Board of Agriculture a gentleman present stated that he had been very successful and had produced good bearing trees which were absolutely borer-proof, nothing injuring the collar of the thorn which then grew wild in the edges of the swamps and low lands, and which, if taken young, could readily be transplanted. His plan was to cut the white thorn stalk off about two feet from the ground and work the quince in; he allowed the white thorn stalks to grow out below the graft, and twined them in with the quince stalks growing above, and thus supported the tree. He admitted that unless properly done the union was not permanent or lasting, but that if done as he described there was no trouble in securing borer-proof quince trees in this way.

Mr. HERR. I rise to repeat what I stated this morning; that I am perfectly surprised that fruit growers, or that fruit men in general, in America, should give their approval to so worthless a pear as the Kiefer; and yet so far as I have heard none of them will even say that it is a tolerably fair pear. I contend that such a course has done much to injure fruit culture in general, and pear culture in particular. In place of being the largest in size, as stated by some of the largest fruit growers of the country, we have, after the expenditure of time and money, a pear dwindling down to the size of the Seckle, and not good in taste; this knocks all the ardor out of the fruit grower.

Can Mr. Moon tell us anything of the Champion quince? I have heard one of our county fruit dealers say that he had a large order for Champion quinces, and another advised him to have nothing to do with it. Some claim that the Orange quince is much better and a more reliable bearer; what do you know of the two?

Mr. MOON. First let me answer as to the Kiefer pear; I was told this afternoon that the people of the cities can so much fruit. The Kiefer pears though raised in the country are not eaten there, but are sent to Philadelphia and find a ready market there and in Boston and New York. There they want pears and are not so particular as to quality; they pay good prices for them and we give them what they want and will pay for. They buy first and pay afterwards; they do not always buy the same kind twice in succession, but they buy and at good prices nevertheless. They may be good enough for city people to eat, but country folks can do better, and do not want them. There are other new pears coming up, which, while they are little better than the Kiefers, are more productive. The day has not yet arrived when (in all cases) quality tells; when that time comes the Kiefer will not be planted, but will have been driven out of the market by better fruit.

I have had considerable experience with the Champion quince, and have grown it for several years; it is a very valuable and reliable quince, bearing the second or third year from the bud, which is more

than can be said of any other variety of quince which I know. They ripen quite late. If the ladies want a quince to do up early, they want the Orange; if they want a late preserving quince, they want the Champion. For productiveness, other things being equal, the Champion is the best; the Orange grows all over your garden, while the Champion grows up into the air, and you can plant flowers and vegetables close up to it.

Mr. WILLIAMS of Bucks. In relation to the Champion quince, I would say that I have raised it and can indorse what Mr. Moon has said in relation to it; the first few years I did not find the fruit to be as good as that of the Orange, but now it is as good or better, and more productive.

The Russian mulberry I have also tried, but have never yet had any fruit from it.

In this connection, I would say that many fruits are highly praised as a market variety without knowing how they will do in the locality for which they are recommended. I believe, as the gentleman has stated, that it is discouraging to the fruit grower to be thus disappointed. There have been large numbers of Russian pears sold in this country because they were cheap, and the colored plate accompanying them very handsome; they have been claimed to be very productive, but I do not believe that those who sell them tell all that has been said about them, or that is known of them. After they are once tried in any locality they are not praised so highly. I find that Mr. Moon and other practical men are not very loud in their praise, although they may have the trees to sell; we have not tested them here yet sufficiently to warrant us in giving an opinion of their merit, either as to quality or productiveness.

Secretary EDGE. It has often seemed to me that the result of local tests, too often based upon the products of a single tree, are very misleading, and often are the real cause of the trouble; twenty feet either way may give an entirely different result with any variety when single specimens only are considered. Twenty feet may possibly make as much difference as twenty miles. We can only properly judge by the result of orchards of considerable size, or from the collected evidence of a very large number of single cases; any other evidence is liable to deceive us. In my travels over the State I have found fruit growers divided as to the merits of the Kiefer pear; some look at it from a market standpoint and judge of its value by the price which it commands in the market; others value it from the standpoint of an amateur, and, of course, make quality the sole criterion of value. It is often the case that a pear of second rate quality, if productive, will pay the large market grower much better than some of our finest kinds; he looks at it from the standpoint of profit and not of quality.

When new fruits or varieties are placed upon the market, the prices are high, and unscrupulous dealers will very often sell old and discarded trees and varieties for the new, and disappoint the grower; in such cases the new variety gets the blame; how often has this been proven true within the past ten years, and with every variety of fruit? From the varying specimens which have been shown to me for the Kiefer, I am satisfied that many have been deceived in their trees, and that they have not the true Kiefer. It must be admitted that the Kiefer is not a first-class pear, and that its quality depends very much upon the success of the grower in ripening it, yet its beauty of growth, and, in proper localities, its productiveness will insure it a place on

the market list until we have something better which will come into the market at the same time and be as productive.

FRUIT FOR THE FAMILY.

By JOHN S. WILLIAMS, *Solebury, Pa.*

Away back in the ages, as far as the mind of man can reach, we find grandmother Eve passing the fruit basket to grandfather Adam, and enjoining him to eat "because it is good;" and, in that beautiful garden of Eden, we learn of nothing more substantial being offered its occupants than fruit. The fact that one tree therein bore the *forbidden apple* was not sufficient reason for ignoring the rest, for many of us in later years, with far more experience than our fair ancestor is supposed to have possessed, in our haste and anxiety to obtain the mysterious marvels of the "catalogue," have had to be satisfied with some very sour specimens.

All the way down through the ages we find that fruit has been an important part of the sustenance of the people; and we are tempted to believe that civilization may be measured to some extent by the attention given to its cultivation.

In no generation of the past, in our own country, has so much thought, and labor and care been bestowed upon its propagation and improvement as in our own, and in no era has it filled so large a place in our thoughts, our homes and our market as in the present.

No class of men are more worthy of the grateful thanks of their countrymen than those who have devoted their best years to the introduction of new varieties of fruit and the improvement of old standards. We can more readily appreciate their efforts when we remember the insignificant strawberries of our childhood and contrast them with the Sharpless and other melting mammoths of the present; or the seedy raspberries of our hedgerows with the Cuthberts and Greggs of to-day. Scarcely more difference is there in those named than in most of the fruits now propagated, compared with those grown a generation or more ago.

With the improvements in the size and quality of our fruits has kept pace the demand. To-day the trade in them is an important factor in our prosperity.

The failure of any one of the principal fruit crops is a misfortune which is felt in the commercial world as well as in the domestic circle; producers complain of hard times, railroad dividends are curtailed, commission houses are minus profits and the vast army of middle men are left for the time without an occupation.

The facility for transporting fruits, both perishable and staple, adds much to their domestic value. Even the most frail varieties are now shipped hundreds of miles uninjured, and are thus placed in homes widely distant from the point of production. At a neighboring railway station, in September last, peaches were being shipped at the same time to Boston, Cincinnati, Syracuse, New York and Philadelphia. The orange and berry crops of Florida are distributed in almost every hamlet of our country. The choice productions of the Pacific coast are sold in every market, while the canned and evaporated fruits of our factories traverse the world in search of consumers.

Can we doubt that the bountiful production and successful distribution of fruit, together with the improved method of preservation, have, to a great extent, revolutionized the contents of the family larder? Within the memory of the writer, it was the prevalent custom of many farmers to "salt down" every fall from eight to fifteen hundred pounds of pork for family use; and *pork* was served hot for dinner, cold for supper and very often in some other form for breakfast. But customs change. Now many farmers sell all their pork, buying what hams and lard may be needed. And why? Because the fruit can has banished the pork barrel. Fruit in its various forms and endless variety, fresh from the vine, or tree, or can, or rich with its juices safely cared for from the evaporator, has taken the place of the heavier meats and forms an important part of almost every meal. It is tempting alike to the eye and appetite, pleasing to the palate and cooling to the blood, leaving the mind clear and the body ready for the active duties of life.

An aged and intelligent physician of very large experience recently remarked in my presence that scrofulous diseases had decreased fifty per cent. within the last fifty years. How do you account for it? I asked. "By the decreased consumption of pork and the increased use of fruit," was his ready answer.

All physicians tell us that sanitary conditions of families having ready access to fruit is much better than those deprived of it. Then let us have fruit, not merely a taste, not as a luxury, but plenty of it. Let us consider it a necessity, everywhere it will fit in our household economy. Ripe fruit is better for lunch than cake, better for desert than pie, better for medicine than pills. The growing of it is a source of unending pleasure. The blossoms of spring greet the producer with their perfume The summer shade of his trees is not the less gratifying if produced by fruit and leaf alike, while full-grown, richly-colored berry, cherry, peach or pear gladden the eye and "make the mouth water."

And yet, scarcely one farm in ten is liberally supplied with it, while many are entirely destitute of its attractions. A quarter of an acre of ground that would yield fifty bushels of corn per acre, with but little if any more care than would produce the corn, will yield an ample supply for a large family, beginning in June with strawberries, followed by raspberries, currants, blackberries, grapes, peaches and pears, if judiciously selected and well cared for, will give you fresh fruit until January, while the surplus canned and supplemented by the apple orchard will carry you over to June again.

Why are so many without fruit and its many advantages? Simply for the want of a little attention at the right time. Everybody intends to plant. They fully make up their minds to that effect when they are enjoying their neighbor's supply, but the ripening season and the planting season are several months apart, and they forget or neglect. Want of time to care for it some urge, yet it takes no more care than the vegetable garden, and not so much if so planted that it can be worked with a horse.

Of varieties I will not speak at length. Each location has some kinds that suit its soil and circumstances better than others. These can be readily ascertained and will be safe to try. There are, however, some varieties of each fruit that do well generally. These will seldom disappoint any one, they may not be the very best, but will be very good until better ones are found. In this list I might name

the Crescent and Sharpless strawberries, the Cuthbert and Gregg raspberries, the Concord grape, the Richmond plum, most of the peaches and the Bartlett and Lawrence pears as having proved most successful in most locations. They may not be the best, but they are all good.

In the great multitude of kinds, old and new, now on the market, there are certainly some that will meet the demands of all. Seek them out. Plant and care for them. They will yield you a rich return on your investment of money and time.

HOW SHALL WE MAKE OUR ORCHARDS MORE PROFITABLE?

By THEODORE DAY, Esq., *Dyberry, Pa.*

It is well known, at least to those who read our agricultural papers, that a few persons get a much higher price for their fruit when sent to market than most fruit of the same kind is selling for at the same time.

This they could not do without taking much better care of their orchards than is usually practiced in this vicinity. We learn, too, that such properly fertilized and cared for orchards are the ones that are most profitable.

During the past season I passed by and through many orchards, and among them all very few trees were properly pruned or cared for in any way, and, as a consequence, most of the fruit was smaller than it should be, and much of it so shaded as to be inferior in color and quality. Among my own trees, those that were well thinned through the whole tops had nearly every apple perfect, and no limbs broken though well loaded; and another thing I consider of importance, such trees are now well filled with strong blossom buds, and I have no doubt that most fruit trees may be made to bear good crops of fruit almost every year where frost and east winds do not blast.

I noticed that where the tops of trees are too thick, the fruit was small, sometimes almost wholly unfit for market and altogether unprofitable. Such trees are so exhausted that they now have no blossom buds, or but a few weak, lean, sickly looking ones, and have made no growth, some of the main limbs split or broken, and some whole trees entirely ruined.

I would here remark that it is the production of seeds that exhausts the trees. and a small apple often contains as many seeds as large ones, and thinning the fruit when it sets too thick, removing all that is imperfect, will often pay as well or better than any other orchard work, and has caused trees to bear full double the amount of choice fruit, making full crops every year, instead of once in two years.

There is but few kinds of apples or pears that are profitable to grow for market, consequently the first thing to do with many trees as we now find them. is to change the tops for those best kinds, and I find the best method is to cut off many of the useless limbs from young thrifty trees during autumn months (old trees with many limbs already dead had better be cut down), then graft the best limbs the next spring, remove natural suckers several times during the summer, and larger limbs each fall, taking those nearest the grafts first, always

leaving enough top to keep all the roots healthy. Grafts and young growing trees should be pruned often, so the top will be always open enough to allow dew, rain and sunshine to penetrate every part when in full leaf. Most trees that are already grafted with desirable kinds I find so very thick as to require two or three years of severe and regular pruning to get them in shape so they can bear desirable fruit when all other things are right.

As to varieties of apples, the well-known Baldwin is largely grown, and does the best of those kinds that everybody has tried, especially where trees lack care as much as they do around here.

A few farmers are learning that the Newtown pippin, when grown as it should be, and rightly handled, brings double the price of the Baldwin, but the tree proves a failure on wet clay soils, and a large portion of the fruit is inferior when trees are not kept well pruned and soil rich.

I learn from a letter recently received from Virginia, that Dr. Hardin Massie of Charlottsville, while a surgeon in the war of 1812, was so well pleased with the Newtown pippin apples, then grown near Newtown, Long Island, that when he returned to his home in Albemarle county, Virginia, he took cions of that and a few other kinds, and the fruit was so much improved there that they felt justified in calling it the Albemarle pippin; hence our Newtown pippin—Virginia improved—has gained a reputation in this and foreign lands as one of the best apples known.

I learn from this letter that it was our seventh President, General Jackson, who chose Andrew Stephenson of Albemarle county, Virginia, as Minister to Court of St. James, and Mr. Stephenson had some of the Albemarle pippin apples sent over to London, and presented a barrel of them to Queen Victoria, with the well-known result of a law admitting those apples free of duty, long before the English free trade laws. The best of these apples brought six dollars a barrel in 1884, near where grown in Virginia, and five dollars a barrel last fall. In bulk they readily brought two dollars and twenty-five cents to three dollars a barrel, and when sent to Liverpool, a clear profit of two dollars to three dollars a barrel was gained, while plenty of other apples in Virginia orchards were unsold the last of January this year, prices offered being very low. My correspondent has kindly sent me cions of the true Albemarle pippin for trial here.

We have another apple called Ledgard, originating on Hiram Ledgard's place, Mt. Pleasant, this county, by strangers grafting in Dyberry township, some years ago, that is a fine looking and better fruit than the Baldwin, superior to it every way, except perhaps quality, and inclined to bear every year. The King apple is also a choice fruit for early winter use, and will keep in a cool cellar all winter.

The gathering and handling of fruit has much to do with its market value. No bruises will be found on the highest priced fruit, and no imperfect specimens among them.

Where the soil is deep enough to plow without injuring too many surface roots, orchards would do best to be regularly cultivated. While trees are small, cultivated crops might be planted between them by using more fertilizers than necessary for these crops, and allowing nothing to grow near the trees, but no sowed crops should ever be grown in any orchard. When the trees are large enough to climb, continue cultivating and manuring, but allow nothing to grow but the rees. Many of our orchards cannot be cultivated, and in such places

we find that manure spread on the surface is very beneficial to the trees, hen droppings is very good, so is wood ashes or lime, and anything that is good for other crops. It is best not to allow anything to grow for at least a foot or two from the bodies of each tree. The use of coal ashes or sand for this purpose would be good. If the grass were not pastured, was cut several times each summer, and allowed to rot on the ground, it would benefit the trees; and a mulch of leaves or straw would be good if rats and mice were kept out, and if put on thick in winter when the ground is frozen, it would retard the blossoming sometimes in spring so as to save the fruit from late frosts. It will be necessary to protect and encourage our useful birds, such as blue birds, wrens, swallows, tree and ground sparrows, and those classes of insects spoken of last year, that destroy others, and aid them in keeping the trees free from injurious insects. Fowls among trees will make good use of many destructive insects, and when wormy apples are falling, sheep and hogs like to gather them and destroy the worms.

Every week when there is no snow, something can be done to benefit the trees, and the more work done as it should be, the better and more satisfactory will be the crops of fruit.

If farmers would all combine in a friendly way to aid each other in the best method of selling their surplus products and purchasing their necessary supplies, instead of trying to get the advantage of each other, as is too often the case, every one would be greatly benefited, because money could be paid nearly every time, and many of the present troubles avoided, and other things besides the orchard made more profitable.

No doubt much could be done to bring about this desirable result by meeting together, say at each school house, several times during the year, to read marked articles from our best papers, and talk over matters of interest to those present. Such gatherings, properly organized and conducted, would no doubt add much to the value of our annual convention.

APPLES—CULTURE AND VARIETIES.

By E. L. WESTON, *Brooklyn, Susquehanna county, Pa.*

By most farmers of this part of our State the cultivation of fruit is thought to be a matter of secondary importance as compared with the main money-producing branch of farming, dairying and stock raising, notwithstanding it should receive more attention than is now given. The apple in particular is treated to more than its share of the grow-if-you-can style, that only at long intervals gives nice crops—the love-me one-minute-and cuff me-the-next way that proves murderously one year and makes a brush heap of a tree eight years in ten. Most of the orchards planted by early settlers here about were on the best plow land on the farm, land that was used in hoed crops—grain and grass—much the same as other meadow land.

Authorities on fruit culture now recommend ground that can be plowed and worked in hoed crops. This may be the most economical way in some sections where there is little rough, stony land. Here, where it is desirable to devote nearly all our smooth land to grass as

the main crop, rougher land can be advantageously used for apple orchards. The main drawback to the use of such land for an orchard site is that the cultivation of trees will of necessity have to be done by hand.

Land for an orchard should be well drained, either naturally or artificially. Wet feet will give an apple tree consumption quite as quickly as it will a person. In starting an orchard on plowable land the grouud should be prepared by two or three thorough plowings previous to setting the tree. With rough land the preparation starts with digging holes for planting the trees. These should be not less than thirty feet apart each way, nor need be more than forty. The holes should be large enough to allow the roots to be spread in their natural direction. Make the holes to fit the trees, not the trees fit the holes. In digging holes keep the surface soil separate from the subsoil so that it may be used next the root when setting trees. Leave a little loose dirt in bottom of the hole; make the bottom rounding, highest in the middle under the trunk of the tree. Too large trees are not profitable for transplanting. Thrifty, well-rooted, four to five feet trees are best. These should have the broken roots smoothly cut off and the tops thinned and at least half the previous season's growth cut from all the leading branches. Care should be exercised in purchasing trees, taking those only that have a good supply of fiberous roots. Machine-dug trees—and most nursery trees nowadays are so dug—if large, have their roots badly mutilated. Nurserymen, in their desire to do a thriving business, often overstate the advantages of fruit culture. Glib-tongued agents with overdrawn pictures of marvelously beautiful and productive new varieties with prices to correspond, should be given the go by. One of our friends, in correspondence with a nurseryman who only talked about the bright side of fruit culture, was told, in reply to the query as to how soon his trees would come into bearing, that "pears sometimes bear the first year and apples sooner."

In transplanting, don't allow the roots to become dry; don't put trees in deeper than they were when taken up. Fill in dirt and work it in around the roots till they are covered; then tread it firmly. Place enough more dirt around the edges of the hole to make a depression around the trunk of the tree; turn in a half or a whole pail of water, according to the size of the tree. This will wash down among the roots. Getting the dirt in close contact with the roots and cutting back the top are most essential to success in transplanting and are oftenest neglected. Fill the hole a little more than even with the surrounding surface and mulch with rotted stable manure. Never water a tree on the surface. Never place manure in contact with the roots.

The cultivation necessary and best after planting and till the tops are large enough to shade the ground is, on plowable land, to use it for some low-growing hoed crops and liberally manure each year. On rough land the surface around the trees should be stirred often enough during the fore part of each season to keep the grass from forming a sod and stable manure, wood ashes, lime, &c., applied. All cultivation around fruit trees should be shallow so as not to disturb the roots. Don't be afraid to make the ground rich. More trees are starved to death than are over fed.

Don't try to grow a profitable crop of hay and a profitable crop of apple trees on the same piece of ground; it can't be done.

Young trees should make an annual growth on leading branches of

from eighteen inches to two feet; bearing trees, from six inches to a foot. After the trees have attained sufficient size to be considered out of the way of serious injury, use the field for a pasture—a pig and poultry pasture. These are the only stock that should be allowed the free run of an orchard. There are no animals their equals as insect-destroyers and consumers of wormy, immature fruit, and they aid materially in keeping up the fertility of the soil.

Pigs confined in small enclosures where there are trees, often destroy them by stripping off the bark. There is no danger where sufficient room is given. If the pigs and poultry only pay for the food consumed and work of feeding, the added quantity and quality of the fruit is a fair profit.

While this treatment is good for the orchard, it is also good for the pigs, producing healthy, wholesome meat, free from germs of cholera and trichina. Make the pork in the orchard and do away with the filthy, disease-producing, foul-smelling blot on nature's beauty—the common farm pig-pen.

One of the important operations in apple culture is pruning and training, an operation often neglected or badly applied.

There are, as a general thing, two ways employed by the general run of farmers: The first is to go to the top of the tree and saw till the limbs drop through to the ground. The second is the let-alone, grow-as-you-please way, and of the two the second is preferable.

All pruning is done for two objects. *First.* Shape and symmetry. This can only be successfully accomplished when the trees are young, and may be done at any season when the pruning knife is sharp. Do not allow but one leading upward shoot, and keep the laterals thinned and evenly distributed. The first lateral or side branches should not be more than five nor less than three feet from the ground. Don't trim trees up; rather trim them down by cutting back varieties of upward growth.

A short-bodied, spreading-topped tree is healthier, longer lived, and less exposed to destructive winds than are high trees.

Another and greater advantage is the greater ease and rapidity in picking the fruit. We have this fall picked two thousand bushels from such trees. One-third were picked in the tree, one-third from a fourteen-foot ladder, and one-third from the ground. Fifty bushels was an average day's work.

Second. Pruning to induce fruitfulness. Whatever threatens the vitality of a tree tends to make it fruitful. Trees only five or six feet high that have been seriously injured by borers or mice, are often seen loaded with fruit. This is in response to nature's desire to perpetuate the species and replace the tree from seed, and is always an indication of the approaching death of the tree.

A vigorous summer pruning, cutting back the new growth, or root pruning, threatens the vitality of the tree and induces the formation of fruit buds, but cuts short its natural term of usefulness.

If trees are properly trained while young, after they have come into bearing there is need for pruning only to remove decaying branches and suckers. When large branches have to be removed, the best season is late summer and early fall, after the terminal buds on the new growth of wood have formed. At this season the surface of the cut hardens and remains sound till healed over. If cut in the spring and early summer the exuding sap induces decay.

While there are numerous species of insects injurious to the apple

tree to some extent, there are only three that do serious damage in this section: the apple-tree borer, codling moth and tent caterpillar.

Of these the borer is the worst. The trees should be examined carefully near the ground at least twice each season. A discolored spot on the bark, if the borer is small, and ejected chips, if large, will give their location. If they have worked into the tree, out of reach of the knife, they can be killed with a small flexible wire.

For the codling moth only preventative remedies can be used. Pigs and poultry do much to prevent damage from this insect. Though found in a half wild state in old fields and hedge-rows in this country, the apple was introduced here from Europe.

Pliney mentions twenty-nine kinds of apples cultivated in Italy about the beginning of the Christian era. Warder, in his work on the apple, published in 1867, catalogues about fifteen hundred different kinds.

Thirty years ago the leading market variety was the Rhode Island Greening; now nothing but red varieties bring the best prices. And yet, with these and other evidences of progress, there are farms that furnish no better assortment for home use or market than Red Astrachan and Russets for summer and fall and Greenings and Gillifleur for winter. Farmers, as a class, do not live up to their privileges as regards fruits. The easily grown and productive apple is not had in sufficient abundance at all seasons.

With so many good kinds to choose from, there should be apples on the farmer's table from one year's end to another.

The Mike apple, with its superstitious drops of blood, the Aromatic Long Stem, the Sicy Red Streak, like apple cuts, are things of the past, only pleasant reminders of boyhood's happy days; other and better varieties have taken their place. In our limited experience for profitable market purposes the following varieties stand in order named: Thompkins County King, Baldwin, Ben Davis, Greening, Northern Spy.

These are all winter varieties. Fall apples are not a profitable market crop. For home use the winter varieties are King, Spy, Greening, Roxbury, Russet.

For a succession for home use summer and fall, Primate, Gravenstean, Benoni, St. Lawrence, Famous, Twenty Ounce.

Sweet varieties, summer and fall, Sweet Bough, Jersey Sweet, Bailey Sweet, Pound Sweet. Winter, Talman Sweet, Winter Golden Sweet. Few farmers appreciate the value of ripe apples as a stock feed. A daily ration to all kinds of farm stock makes sweeter and healthier pork, richer and yellower milk and butter and a shiny coat for the horses, and makes the dry feed go farther.

An apple eaten before each meal is better for a person than some costly medicine, and pleasanter to take.

Branson Alcott, the Concord philosopher, attributes his unimpaired health and mental vigor at eighty to the free use of apples as an article of diet and praises their health-giving properties by saying, "Eat apples and live for ever."

One of the pioneers of American horticulture aptly says, "Fine fruit is the flower of commodities, the most perfect union of the useful and beautiful that the earth knows. Trees full of soft foliage, blossoms fresh with spring beauty; fruit rich, bloomdusted, melting and luscious, such are the treasures of the orchard and garden temptingly offered to every land owner."

JOHN I. CARTER of Chester. This essay is the kind which we so much need at our meetings; it is practical, and in a short space covers all of the ground. It is a valuable addition to our knowledge of apple and apple culture.

Question. Is the Summer Pearmin a valuable apple with you?

E. L. WESTON of Susquehanna. We did not grow it in our orchard and I am not acquainted with it. As a rule we do not grow sweet apples; we find the sour or tart varieties much more marketable and desirable. Sweet apples may be profitable for stock.

J. A. HERR of Clinton. In my locality we make a great deal of apple butter and need sweet apples for this purpose and to mix with the sour ones. We also prefer some sweet apples for fall and summer use, but for apple butter we want some sweet apples.

H. L. SCOTT of Bradford. Can the essayist tell us anything of the value of the King of Tompkins County apple. I planted some but they were short lived. Is this a trouble with that variety?

E. L. WESTON. Our orchard was set out in 1859 and is not yet old enough for me to fully answer the question, but from what I have seen of them, I do not suppose that they are as long lived as the Russett or Greening.

M. W. OLIVER of Crawford. We find the Greening to be a very valuable apple. Can you tell why the nursery catalogues have thrown it out during the past few years?

E. L. WESTON. I do not know why it is unless they find but little demand for them. If any variety is wanted they will take care to keep it in stock.

E. M. TEWKSBURY of Columbia. I think that our people have as a rule discarded sweet apples as market varieties, and I presume that it is because the purchaser does not want them. As to the Gillyfleur, I think that they should be more extensively planted than they now are. I have several trees and they have always done well and have proven productive. The Greening and Russett are "down east Yankees" and are tough and long lived; but the kinds which are first class winter varieties here do not do so well in our more southern counties. When I left home my Greenings were all on the ground and had been there for some time.

Secretary EDGE. I think it will be found that the trouble with many varieties of apples, which in northern Pennsylvania and New York are valuable and satisfactory winter varieties, and which do not prove such in southern Pennsylvania, is that we come north, mainly to New York, for our trees. The bud carries its season with it and thus what would be a winter variety here and in New York becomes an early fall variety in Chester county and the southern part of the State; thus, with us the Baldwin and Falla water, which here and in New York are good late apples, are with us early fall apples; they are all off the trees too soon to pack them away for the winter. We all know that even the little bud used in grafting is capable of influencing the whole character of the fruit produced in after years, and I think that we are safe in assuming that one from a northern tree will carry its season with it and that if a large number of grafts be taken from a tree in northern New York and grafted in a large number of States and indifferent latitudes, it will be found that all will ripen and fall at above the same time, the graft or bud having carried its season with it. If this is correct then we have a remedy in going south for our buds and grafts, but there we are met by the difficulty that we have

no really good southern late apples; too many of them come from the north and are good fall kinds. They do not remain on the tree late enough for winter use.

R. S. SEARLE of Susquehanna. May it not be the case that a lack of rain may cause the fruit to fall early? When they are growing, apples need a large amount of moisture, and not getting it at the proper time may possibly fall on that account.

E. L. WESTON. We notice this year that some varieties of winter apples which heretofore have remained on the tree until very late, have fallen off. We attribute this to the warm weather which followed the frost which we had. We never noticed to so great an extent as this year.

Question. Do you raise any Falla waters in this county?

E. L. WESTON. We have no experience with that variety.

C. EVES of Columbia. The difficulty to which our Secretary alludes does exist and the question is. as has been suggested "What are you going to do about it?" In Columbia county out trees sometimes bloom in April. We used to plant corn when the apples were in blossom bnt we cannot do it now. When your fruit is ripe, pick it in the barrel.

Governor BEAVER. A gentleman has remarked that apples are the forerunners of civilization but I think that there is good cause for the belief that an apple was the cause of the downfall of us all, from the beginning. After all the trouble came from only one kind of apple and probably this was neither the Greening, the Baldwin or the Russett. It is wonderful, Mr. President, how many of the questions raised by Mr. Grow and myself, during our ride over from New Milford, have been answered here. We agreed that the Greening was about the best, and for all purposes I am not sure that we were not about right. But there is another question involved here beside and beyond that of apple growing and which runs into the confines of political economy. and that is the idea of one region supplying the wants and needs of another. Does it not seem to bring us closer together? From here to New Milford we passed piles of Greenings, Pippins, Baldwins and other varieties. What does it suggest? Simply that Susquehanna county should raise winter apples and ship them to points in the State where they are not produced. It is true that the question of transportation comes in here and is to a certain extend an impediment in the mutual exchange of products. Another question and one which we probably will not be able to influence is the adaptability of our climate. If your climate will produce winter apples and ours will not, nothing seems more reasonable that to infer than you should raise our winter apples and we in return will produce something which you need and cannot produce profitably.

METHODS AND PROFITS OF STRAWBERRY CULTURE.

By G. R. RESSIGUIE, *Brooklyn, Susquehanna county, Pa.*

At the present time no subject, save butter making, is interesting our farmers more than fruit culture. Properly conducted there is a small profit in it, otherwise just as much of a loss as one is a mind to make it. Our location is favorable and our climate and soil well adapted, notwithstanding the State Geologist says the latter is very

thin; he sampled it on the hills. We have direct railroad communication with New York and Philadelphia, and the advantages of one of the best local markets in the country—the anthracite coal region. The cities of central New York offer us a good market for our early fruit. The great reason why we don't get more money out of it is because we don't put more in, thus producing a greater amount of fruit at a much better price. As one of our own growers has said: "We must grow such fruit as will create a demand for Susquehanna County Association's berries." What applies to berries will apply to other branches of fruit culture. The average yield from new strawberry beds belonging to our association members was this year a little over one hundred and fifty bushels per acre, and we intend to raise it to two hundred bushels. A number of our members went beyond two hundred bushels this year. The trouble is we still cling too much to the old bed, the small varieties, the wide-matted row and a careless manner of picking and packing. These evils must be eradicated before we can reach that standard for which our aim is set. But one or two members in each section following out the plan and getting two or three cents more per quart will surely work out wonderful results. It is better than a thousand theories—that extra two cents. This year the supply of small fruit was no where equal to the demand and prices were satisfactory.

The strawberry, like all members of the rose family, appreciates a favor and makes faces at a neglect. Its pulpy receptacle increases in size over the wild varieties much more than its sister members of the "rose family proper." New varieties are produced from the seed and some of our own seedlings do well, but the great majority are worth less. Two theories are presented as to its origin. The first arose from the old English custom still used of putting straw between the rows for a mulch. The other and more accepted one is from the Saxon "Strae," meaning straying berries.

The person who goes into the business rough shod, thinking he is going to have a picnic and lots of money, at the end of the first year will come out knowing that he has had a picnic and lost lots of money. Our county produced last year about ten thousand bushels—not a full crop. The average price above express and commission was about two dollars and twenty-five cents per bushel.

There is a multiplicity of details in the growing of small fruits, any one of which neglected will materially decrease the profits. Great care should be exercised in selecting and preparing the soil, choosing plants, setting plants, methods of culture, care and cultivation of plants, manuring, mulching, purchasing crates and baskets, picking, packing, shipping and marketing.

In this county four varieties of soil present themselves, each with its advantages and disadvantages. The clay of our uplands is prone to heave out the plants, subject to washing rains, requires more cultivation and ripens the Crescent and Downing at the same time the river berries from central New York are placed upon our local markets. But one is more sure of a full crop. Jack frost is not so apt to attack them. You are quite sure of a good growth of plants and for very late berries such a soil has a decided advantage. Rich muck lands well drained give us the largest crops, but on such soil berries should never be grown in wide-matted rows. The gravel beds of our low lands are unsafe. They are too dry, too early and too stony.

However, the earlier you can get berries to market the better the

price, but remember the frost. The rich, moist sandy loam of our valleys is well adapted to the berry. and it does well on this soil, cultivated in any manner. Growers who have such land have the advantage of a very early market, and by mulching heavily the late varieties, they are equally blest with the late market, thus avoiding the local glut. The frost is always heaviest on such soil.

Select land that has been cropped at least two years—never green sward, it is subject to the red-headed grub. Some say you are safe from its ravages if the soil is broken in the early fall and cross-plowed just before winter. Soil must be moist—rich enough for a large crop of potatoes. Plow in the fall, and again in the spring if possible. Harrow the ground well and roll it. Don't mark it out, as you are prone to get the plants so deep that the first rains will cover the crowns. Get your plants from a neighbor, if you have to pay twice as much for them. We never have had success with foreign plants, only in introducing into our beds the strawberry worm and other pests. Dont get them until you are ready to set them. Purchase several varieties and see which does the best. Sometimes a berry will do well on one soil and be a total failure on another. You should have about an equal number of the pistilate and hermaphrodite varieties—the latter is a perfect flowering berry, and can be distinguished by its anthered stamens sticking up in various parts of the flower. The hermaphrodites that do the best with us are the Chas. Downing, Sharpless, Miner's and Wilson's; the pistilates are Crescent and Manchester. Pistilates are best yielders. Don't invest too much in fancy varieties; leave that to the man who has money to spend rather than to raise. Set in the spring as early as the ground will allow. Use a line; tie colored strings every twelve inches for "hill culture," every sixteen inches for matted rows unless soil be very moist and rich, then twenty inches, or even twenty-four will do. Take up plants, clean with a potato digger—you don't cut the roots. It is best to set out each year a small bed just for plants. Scatter the roots, lay them deep, firm, well, and don't cover the crowns. As fast as plants die out set in new ones. There are several methods of culture, each requiring different treatment.

Most growers cling to the wide-matted rows. Plants are set sixteen to twenty-four inches by five or six feet, and a row of potatoes or corn planted between them. The advantages are no loss of ground the first year, less plants to set, not so much cultivating, and gives the red-headed grub more to work upon.

The disadvantages are smaller plants, smaller berries, hard work to keep centers clean, center of row is exhausted to furnish runners, apt to be too thick, and best berries are mashed by the pickers or the clusters broken down.

In hills plants are set twelve inches by three or three and one-half feet and shoots not allowed to run. The advantages are larger berries with a few varieties; more bushels; better if you are going to run beds two years; not so hard to keep clean, and less berries to handle for the same profits. The disadvantages are—more subject to frost, less bushels with same care, takes more time to cultivate, pests are more apt to destroy plants and it requires so many plants. Narrow matted rows are set sixteen to twenty inches by three and one-half feet, if ground is poor; four feet, if rich; and runners are kept off until the plants are well started, then allowed to fill in, not too thick. The advantages are a combination of the good points in the other two methods;

by rejecting the disadvantages of each of them. We have secured the largest crops by this method and nearly as fine berries as by "hill culture."

There may be those who have produced more bushels of berries by "hill culture," but I have never met them. Most growers let just enough runners grow to form the narrow-matted row, and then say they keep their plants in hills. Don't let the weeds get started. Cultivate and hoe just enough to keep the plants clean and ground loose. Don't "hill up" the rows or dig out around the plants so as to expose the roots; never cover up the crowns. When plants are well started —about first of June—put on four hundred pounds bone dust to the acre. Wood ashes are good enough if you have an abundance of them.

We put on phosphates or ashes twice during the season; it pays.

Late in the fall we put on twenty-five loads horse manure per acre. This furnishes a partial mulch and feeds the plants in the spring. Near the close of winter put on straw for mulch; put it on just before or just after a storm. The mulch keeps berries clean and holds moisture nearer the surface.

In the spring scrape the straw partially off the plants into the rows. If you want berries late, leave this until plants begin to peak out. The The "Disbron Climax" crate (thirty-two quarts), manufactured at Rochester, gives us good satisfaction. It has one objection—the sides being made of sheet iron, squash out when several crates are placed on top of each other. The small basket well filled gives best satisfaction. You will send out good baskets; you will get back poor ones. Expect it, and don't grumble. You will need enough crates to market nearly half of your crop at one time; you should have one-half as many extra baskets as you have in your crates. Select pickers who are old enough to have some judgment; give them their rows for the season; don't let them take more than six baskets into the field at one time; don't allow them to shingle the top with the largest berries or the bottom with leaves and green clusters—better the former; have an overseer; pay pickers by the day. The bulletin board is better than the ticket system, if you pay by the quart, as there is no loss of tickets. Don't put leaves on berries or turn the top ones, unless it be at the first of the season; it makes them mussy.

You can't very well pick too green.

Don't pick nubby or small berries; they don't pay for marketing. Pack with care and place poorest layer on top; it accommodates the station boys and train hands. See that boxes are tight in the crates. If berries are overripe Saturday afternoon, pick them and keep in a dry, cool place until Monday morning; then pack and put them upon the market.

Many of our growers live twelve or fourteen miles from their shipping station, and they have to take great care in picking and packing. Don't ship any more berries to wholesale dealers than you are obliged to. The cost of raising an acre of strawberries is much more than one would think for.

Cost of fall plowing,	$2 00
Cost of spring fitting,	3 00
Seven thousand plants,	14 00
Setting the same,	10 00
Cultivating and hoeing six times,	30 00
Four hundred pounds "bone dust,"	8 00
Twenty-five loads manure and hauling,	32 00
Mulching,	10 00
Loss on crates and baskets,	20 00

Uncovering,	$2 00
Picking one hundred and fifty bushels,	90 00
Carting,	25 00
Marketing expenses,	20 00
Total,	$267 00

To this we may add seventy-five dollars for express and commission, making a total of three hundred and forty-two dollars, or seven cents per quart, even if we are sure of a crop. When berries sell for less than seven cents a quart. you get nothing more than the price of labor, and the rent of land is out of the question.

Now, if you add to this the expense of cultivating one year of every five for nothing, you will see that berries must sell for ten cents per quart in order to return the grower a good rent for his land. The greater the number of bushels raised per acre the greater the profits.

R. S. SEARLE of Susquehanna. Will not the horse manure, which you state that you use to cover your plants, carry seeds of weeds into your patch?

G. R. RESSIGUIE. There is a great difference about horse manure about that; if the hay fed to the animals contains many weeds and they were allowed to ripen the seeds before cutting, many of the seeds will escape the digestive organs and will thus carry weeds into the strawberry patch, but I am very careful to know something of the hay fed to the horses and the straw used in the manure.

Dr. J. P. EDGE of Chester. We have with us a gentleman who is known all over the State, and I should be glad to have him address us upon the strawberry question or upon any topic he may select.

Hon G. A. GROW. I am not an authority upon strawberry culture and could get along much better with pumpkins. I came over from New Milford with the Governor, and on our way we, as we thought, fully discussed the apple question, but after hearing the essay I find that we barely touched upon some of its most prominent points. No one man or one section can produce profitably all that it requires: if the members of the Board want our Susquehanna county apples let them come up here and live and thus save the cost of transportation, of which Mr. Searle complains so much. Now, Mr. President, I am just from our centennial, and have been talking there and at any rate I am like the Irishman, who, during a severe storm at sea noticed that all of the passengers were engaged in prayer, thought he must take a part and so he commenced somewhat in this way: "Oh good Lord you know that I am not one of the kind that is always troubling you, and therefore please grant my request."

J. A. HERR of Clinton. I feel certain that we in Clinton county might raise strawberries and send them up here to pay for the apples which we all want so badly; we can raise them at three cents per quart. the essayist puts the cost at ten cents I believe.

G. HIESTER or Dauphin. Will the author of the essay explain the use of the bulletin board to which he alludes in his essay?

G. R. RESSIGUIE. The names of all of our pickers are written in a column on the bulletin board, and when John Jones come up with six boxes or baskets we write the figure six in the column opposite to his name; when the next comes he is in like manner credited with the number picked and brought in at that time; then at the end of each day we can readily tell exactly how many boxes or baskets each one has picked, and we can settle with each accordingly.

G. HIESTER of Dauphin. I use tickets, and when a picker brings in five boxes I give him a ticket with the figure five on it, at any time when he has enough tickets he can exchange them to the amount of fifty for one "fifty" ticket; if he loses his ticket he loses his money for picking; we only redeem tickets that are presented, we keep no accounts with the pickers.

G. R. RESSIGUIE. We have tried the ticket system for a number of years and have discarded it for the system which I have described; when we had the ticket system we frequently had quarrels among the boys; tickets were stolen or lost; with the bulletin board all danger from these sources is avoided, and we can at any time see exactly what each picker is doing and each one can see that his account is fairly kept; all are satisfied, and we like the plan much better.

FRUIT CULTURE.

By Dr. JAMES CALDER, *Harrisburg, Pa.*

The subject upon which I have been requested to write embraces so much that a full discussion of it would require all the time set apart for the continuance of this meeting. The fact of its having been named shows an interest concerning it, and such a call reveals a duty which each one of us should strive to perform according to the knowledge which he possesses. While neither this essay, nor the remarks which it may call out, can fully set forth fruit culture, and send us home with all the information that is desired, we certainly can be helpful to each other even if we touch the question in only a few of its points, and consider them in the most general way. This much, at least, let us try to do.

For several reasons it may be claimed that fruit culture is a matter of sufficient importance to merit the attention of every farmer. If there were no other reason, I would say that the simple fact that attention to it does much to break the monotony of ordinary agriculture, presents it as a pursuit of which he should have practical knowledge. It is not antagònistic to other departments of his business, it does not unfit him for the growing of grain or the raising of stock, but actually helps him in them by affording him relief from too constant attention to them, and giving a kind of recreation which a man may indulge in even if he be a hard working farmer. Much can be done at it in the odd moments when one is waiting for the best hour to do more important work, or when health or the weather forbids labor in directions where lie his chief desires. At such times the setting out of a few plants, the pruning of a tree, or the training of a vine will give a pleasure which no thoughtful man will despise.

But some attention to fruit culture on the part of farmers in general is advisable for the additional reason that it is a step in the direction of mixed farming—a system much less followed than it should be, as is indicated by the independence and pecuniary profit which it brings the individual farmer, and the large degree to which it promotes the general welfare. The ownership of a number of fruit-bearing trees, plants and vines well suited to the soil, climate and market demands of one's locality, gives him a great advantage in the effort to make farming pay. It does much to add variety to the produce which

be offers consumers in his neighborhood, thus inducing them to prefer to deal with him; and for a large part of the year it gives him something to sell which is always in demand, and which, in the maturity of the plants and trees, pays better than any equal expenditure of money or labor on the farm, except, perhaps, bee keeping.

In its bearing on the exceeding important question of health—the health of the farmer and all the members of his household—I presume no one will deny that the raising and consuming of fruits is one of the most certain methods of securing and preserving this great blessing. For various reasons farmers are great consumers of flesh. To use this article of food less frequently, and to choose home-grown fruits as a substitute, would, undoubtedly, be more healthful, less expensive, and require much less labor on the part of the female portion of the household. Each of these reasons is sufficiently important to demand the favorable consideration of a man who is progressive enough to be interested in the State Board of Agriculture and to attend its meetings.

In a rapid glance at this subject, which is all that the time will allow us, it will be well to notice some of the errors concerning it which are most common. One which is very frequently made is in the selection of varieties. Old varieties, as the Isabella, among grapes; the Angers, among quinces, and the White Dojenne, among pears, are still planted; but in comparison with many new kinds, they are unworthy of consideration. Those who depend upon them are disappointed, and justly conclude that fruit culture is neither pleasant nor profitable.

Mistakes are made as to the age and condition of trees, plants and vines at the time of setting out. Those that are old and large find preference; whereas, other things being equal, we are more likely to secure success if we select those that are young, even if they are small. A great wrong is done in transplanting by the mangling of the roots and the failure to shorten the branches in proportion to the loss of roots. Many a tree and vine is lost because he who sets it out permits all its branches to remain, whereas a proper reduction of them to suit the condition of the roots would have required the removal of the greater part of them.

That which is called "pruning," as that work is generally performed, is an endless contributor to failure in the growing of fruit. The custom is to neglect the tree or vine in its early life, when but little care would be required to give it proper form; and then, after years of neglect, attack it with axe and saw, in freezing weather, and cut and mangle it to such a degree that all beauty is destroyed and little is left but life, and that of but little use.

Another evil is in not caring for the fruit which is raised. Much of it is picked at an improper time, when it is neither so palatable nor so salable as it would be if good judgment were used. Much is almost wholly uncared for after its maturity, so that a large portion of it is lost by decay, and the remainder is taken to market in such a condition that the money returned for it is very small Proper assorting, scrupulous cleanness and fairness in measuring in marketing, together with a large use of the processes of drying, evaporating and canning, will successfully handle large crops of fruit and so increase the grower's bank account as to put him on the affirmative side of the question, "Does farming pay?"

I claim that every landholder should be a grower of fruit. He

should grow not only enough for his own household, but also do something towards supplying the demand which will come from people in his neighborhood who cannot raise fruit for themselves. More than that, he should consider it his right and duty to compete as far as practicable with other fruit growers who supply markets which are at a distance from himself. Often he will find that it is the distant market which pays him best.

He can do much in the raising of trees, vines and plants for himself. A little nursery, a kind of "catch-all," in which he can raise stock to be transplanted, test varieties, &c., will occupy little space, cost little money, preserve many a plant until a place is found for it, save many a dollar, afford an attractive school for the children, and give much pleasure.

When setting out trees, &c., it will be found advantageous to plant them in long rows, as this arrangement favors their cultivation while they are young by the aid of a horse. As a rule, hoed crops may be planted between the rows until the fruit comes into bearing, with advantage as to receipts and no injury to the trees.

It is well to plant annually instead of at intervals of several years. Injury and death are continually assailing our orchards and vineyards and berry patches; and a cessation of planting for a few years will make inroads upon our productive stock which will materially diminish its profitableness. Moreover, new varieties are announced almost every year, some at least of which come so well indorsed that we may set out a few on our grounds with but little fear of unsatisfactory result. And, still further, is it not the duty of every enterprising farmer to take some part in the important work of experimenting, whereby the unworthy candidates for favor will be detected, and those which merit general adoption will be enabled to prove their worth, so far as his locality is concerned? Moreover, the claim of posterity to have ready for their use enough of the very best fruits we can leave them is one which every lover of the Golden Rule will admit; and even he in whom self-love is dominant will find that in preparing his farm to gratify his successors with the finest of fruits he is first of all blessing himself with the same. For the old adage,

> "He that plants pears
> Plants for his heirs,"

does not mean that he will not live to enjoy the result of his labors; but that the pear tree, though slow to mature, will live so long as to afford pleasure to his descendants as well as to himself.

In selecting the kinds we would set out it is wise to prefer those which have proven hardy in our neighborhood and well adapted to our peculiar soil. A variety which does well elsewhere may not be suited to our own grounds. Much loss of time and money has been caused by overlooking this point. For example, the Catawba grape ranks as number one in a few localities in Pennsylvania, but in the majority of our counties it is utterly unsatisfactory. The King apple, of western New York, does well there, just as the much-abused nurserymen from that section tells us; but it is not a good variety in most parts of our State.

It should be our aim to have our collection of fruits embrace not only apples, a few cherries, fewer peaches and a pear tree or two, but also quinces, grapes, currants, gooseberries, strawberries, raspberries and blackberries. If one is sufficiently advanced to have on his premises a poultry house let him go further and attach to it a chicken

yard in which he will plant a half dozen plum trees, and he will thus add to his fruit supply an annual crop of plums, in spite of the curculio.

Having raised the fruit the right-minded farmer will see to it that those who first and most constantly partake of it are the members of his own household. While it is wise to grow some fruit that we may sell and make money it is wiser to have all at home eat enough to make them love home and keep in good health.

Having commenced the good work of setting out and caring for fruit trees, vines and plants the farmer should never cease from it. Year by year as age steals on him this commendable interest should be a proof of his taste, sound judgment and kind regard for those who shall come after him. As he turns his face to life's setting sun he should aim to leave the world, as fully as he can, a garden of fruits and flowers, as it was when the Creator gave to the first man in his innocency the command to live upon the fruit of the trees which he was to dress and to keep.

THE "PRO" AND "CON" OF FRUIT GROWING.

By J. A. HERR, *Cedar Springs, Pa.*

By divine ordinance we are doomed to labor for what we eat. The growing of fruits is no exception to this decree.

Everything of value seems to cost labor in proportion to its worth, whether it be the product of the soil, of the mine, or the mechanism of man's hand, and we usually appreciate it according to this standard of value.

The value of fruits is measured largely by this same gauge.

The inducements to fruit growing are numerous and inviting, while the hindrances and objections to it may be said to be equally plenty and discouraging. A few thoughts on both sides of this question will be briefly presented in this paper.

We will first consider the favorable side, and present some of the *inducements* to fruit growing.

The vast majority of the people of the earth have a strong natural appetite for fruits in all their variety. This appetite increases as we leave the frigid and approach the torrid zone. Fruit is beautiful to the eye and tempting to the palate. It forms a large part of our diet and is the healthful and delicious part of it. The supply has never equalled the demand and probably never will if an equable distribution be made. It is of such variety in quality, time of ripening, length of season as to be available fresh in some of its forms to almost every person everywhere and at all times. It can also be preserved in various ways so as to be carried to all habitable parts of the earth. from the Esquimaux to the Hottentott, giving variety to their diet, and health to the consumer. The health of mankind largely depends upon the consumption of fruit, which in its great variety serves to free us from the evil effects of a diet consisting largely of animal food.

These are sufficient reasons why fruit should be grown wherever the natural conditions for growth are favorable.

Some of the more direct influences to fruit culture are the following:

Fruit growers are chiefly employed in the open air, and consequently are healthy and vigorous. Their labor is cleanly and free from the noxious odors common to employment in many other occupations. It is also varied and freed from the monotony of mechanical labor.

The daily contact with nature and her works in all their beauty and variety, from the development of the earliest bud to the coloring and falling of the last leaf; from the unfolding of the tenderest blossom to the maturity of the latest fruits, gives an inspiration to labor that can be derived from no other source.

The propagation and cultivation of fruits afford abundant opportunities to the ambitious mind for further development. The possibilities of fruit culture are unlimited to human minds.

When we consider that our most luscious fruits originally sprung from the most common, disagreeable, inferior, natural product, and were brought to their present state of perfection by the careful intelligent selection and cultivation of the fruit grower, we are led to the inquiry, "What may not the future bring to us?"

The improvements in our common fruits by cultivation, hybridization and inoculation is ample evidence of what the intelligent pomologist has done, and affords great inducements to the ambitious mind to further experiment and investigation.

The *vital* and *pivotal* question in fruit growing is, "Does fruit growing pay?"

This depends upon various circumstances and conditions coupled with the intelligence and thrift of the grower.

In an average good location and an average season the intelligent and industrious grower will certainly reap a fair reward for his labor. The risks are no greater than in any other agricultural pursuit, while the chances of large profits are largely increased.

The hindrances to success are legion, but the quality and variety of the products are so great, that an entire failure is scarcely possible.

The wide-awake grower will study his market and its wants, and will select such character of soil as will by proper management produce the desired product; then by the use of the proper fertilizers and cultivation he can, with a great degree of confidence, expect a reward for his labor. He will also need to study the most improved appliances in cultivating, gathering, handling and preserving his products, so as to have them in the best possible condition, and marketed at the most advantageous time.

It is also important that he has the proper name of each variety of his fruits and sells it by that name. This seemingly unimportant and commonly neglected matter can scarcely be over rated.

When a choice variety of fruit becomes known to the public by a proper name, it is sought for by that name and commands a price to correspond with its quality.

It is not a difficult task for the grower to familiarize himself with all the varieties of fruit he cultivates, and to cultivate too many varieties is neither desirable nor profitable.

We must also remember that the business of a fruit grower is not made in a single season. It frequently requires years of patient toil and study to establish a successful business. A reputation once established in fruit growing brings with it a remuneration commensurate with the time and labor expended in acquiring it.

Another important inducement to fruit growing is the fact that intelligent men who make fruit growing a specialty are scarce and in

demand. Let each one for a moment glance over the community in which he lives and see how many he can enumerate. He will be truly surprised at their scarcity. Surely "the field is large but the *skilled* laborers are few."

Our markets are seldom overstocked with good fruit, and each year brings greater facilities for its cheap distribution over a larger extent of territory, thus enabling the grower to vary his market and enhance his profits.

After enumerating some of the *inducements* to fruit growing, it is but just and fair that we should look upon the adverse side of the question and note some of the hindrances.

We have already stated their name is legion. Many of them may be overcome but some are beyond our control.

The first and most important of these is a want of a proper situation. It is the minority of farmers who have farms suited to general fruit culture, although the majority may successfully grow some kinds of fruits.

The peculiar situation, character of soil and degree of elevation are to be carefully considered. It would be folly to attempt to grow peaches extensively in a locality where the trees are in great danger of being killed by frost, or to grow apples on land poorly drained. Yet plums might be grown successfully on these grounds. A proper situation is of primal importance.

A very great hindrance to fruit growing is the insect enemies to both trees and fruits. The principal of these insects are the borer in apple, quince and peach, the codling moth in the apple and pear, the curculio in the plum, pear and apricot and the caterpillar on almost all kinds of fruit.

These pests may be largely overcome, but it requires time, patience and perseverance. A constant warfare during the proper season against these enemies is necessary to success.

Another objection to fruit growing is the time required to realize from the labor and investment. The cultivation of fruits is a life work and should be commenced early in life to allow proper time to experiment with and test varieties of fruits. The inexperienced should begin on a moderate scale and enlarge as time and experience show it to be profitable. We can have access to books and periodicals containing the experiences of others, of which we should avail ourselves. The experience of others in our own immediate neighborhood would be doubly valuable.

We cannot be too careful in the selection of the proper nursery stock to begin with. The dissatisfaction arising from mistakes in dealing with unreliable nurserymen or unscrupulous dealers and agents has been a prolific source of mischief to fruit culture. The mistakes of even reputable nurserymen have often caused great dissatisfaction to the grower. My own experience in this matter has been very annoying, although exercising great care in purchasing from reliable nurserymen. Another drawback to fruit culture extensively is the fact that it requires considerable capital and time to purchase and properly equip a fruit farm.

The inducements to lessen labor and quicken results with less capital offered by various other industries, is probably the greatest drawback to fruit growing.

We are all looking for quick returns from our investments and labor in this age of steam and electricity, and it is but the few who are

willing to work and patiently wait for the results to be obtained in the cultivation of our large fruits.

In considering the arguments for and against fruit growing, we draw the following conclusions:

The person who makes a specialty of growing fruits must seek a location where the natural advantages of situation, soil and climate are favorable to the business. Then, with an adaptation to the business and an energy worthy of the occupation, he cannot fail to reap a rich reward for his labor, both in the pleasue it affords and the money it brings.

The average farmer will do well to select his most favorable spot, and cultivate the fruits that will best succeed with him.

There are few farms so unfavorably located as to be incapable of producing some of our valuable fruits. He should study carefully the situation, and gradually, as experience teaches, extend his planting of fruits of the kind and varieties which prove profitable, remembering, however, not to plant more than he expects to be able to cultivate.

This is a duty we owe, not only to ourselves, but to those who succeed us. It requires years of time to obtain the best results from our large fruits. We are indebted to our ancestors for many of the fruits we now enjoy, therefore it is not only a duty, but should be a pleasure to plant and cultivate for those who follow us.

It is our duty to afford to the public as great an opportunity as possible to learn the value of fruit as an article of food, also to learn of its proper name and varieties, and of its quality and uses. To this end we should seek to make our agricultural fairs not mere places of amusement, but a school of instruction, where people will be the wiser and better for having attended them.

More generous premiums should be offered for the various kinds of our valuable fruits, *properly named*, both in their natural condition and preserved for family use, thus inviting a larger and better display of this most valuable of exhibits.

Then we should have a committee to examine and judge these exhibits, who are competent to correct errors in wrongly named exhibits, and name varieties not already named. This would afford great gratification to the fruit growers who have not the proper names of their fruits, as well as the general public, who wish to learn of fruits by their proper names. Otherwise the display of fruits would be no more instructiove than what may be seen in the common fruit store, where the best fruit of the surrounding country is sold.

It would be well to offer special premiums for new and valuable fruits of recent introduction, which have been sufficiently tested to prove their value.

The enterprising fruit grower must see to it that his products are not under rated or discriminated against by a class of persons who cater to the passions and excitements of the public, by providing amusements which absorb nearly all the funds of the exhibition, leaving to the horticultural department a mere pittance with which to afford an inviting exhibit.

When fruit growing shall receive the consideration its importance demands the fruit grower will not go unrewarded.

R. S. SEARLE of Susquehanna. I believe with the essayist that one of the primary and most important steps is the selection of a suitable location for a fruit orchard; it is a comparatively easy matter to select

and buy the trees, any practical fruit growers can post you in these points; our subsoil is a hard pan and we have to take it or none for our orchards, it is impervious to the roots, but by a proper drainage and water storage system we may make it one of the best soils for fruit culture. Now I know by the looks of some of my friends that they are ready to say, "now that is Searle's hobby of Cole's system;" of course, as you all know, I think that this system will bear a critical examination; it will pay. The trouble with fruit during a dry season is that when it is setting and swelling, or at the very time we need the most water, we usually have a dry time, and we fail to get full-sized and perfect fruit; it becomes prematurely ripened. This year this was not the case, and we have large crops of perfect fruit; next year it may be the reverse, and we may from this cause alone have a failure. The system is peculiarly adapted to our country, because of the hard and impervious hard pan with which we have to contend. If we dig the hole for the tree any deeper than the natural soil, it is equivalent to placing it in a water tight box, and all the surplus water will settle in the whole. The trees suffer during a part of the year from too much water, and during the remainder from the want of water; our rains come in the spring and furnish us with more water than the soil will hold, but not with more than we would need if we could keep it until it is needed; the surplus rushes off into our creeks, and carries with it much of the fertility of our hillsides; in the Cole system the ditches act as a filter and retain this surplus moisture, and it is wonderful to see the effect when, later in the season, the surface moisture is exhausted and by capilliary attraction the water stored up in the ditches is brought to the surface just at the time when it is most needed; it is a perfect system of drainage, accompanied by complete surface irrigation; it combines the two—drainage and irrigation.

Question: Would it not pay to break up this tight sub soil and thus permit of the entrance of air and moisture?

R. S. SEARLE. Sometime ago a gentleman who owns land near Tunkhannock came to one of our farmers' meetings to learn something as to the proper mode of breaking up the sub soil; he purchased a subsoil plow but did not get it strong enough; he afterwards got a stronger one, strong enough for four horses; after using this plow he never failed to get a good crop; he is a very reliable man.

WILL B. POWELL of Crawford county. All is not gold that glitters, and underdraining, like a two-edged sword, cuts both ways, and in many places is very detrimental; take for instance that portion of Erie county near the lake, it has, at least much of it, been underdrained, and what is the result? The underdrains carry off the rain of to-day so quickly that to-morrow the ground is again dry; underdraining carries the water too quickly away from our side hills. I have in mind a meadow which has been well underdrained. My father used to cut good grass from that meadow in September; at that time the fields surrounding the meadow were in with heavy timber, the woods retained the moisture and gave it up to the land slowly and as wanted, now the fields around the meadow have been cleared and the meadow underdrained; as a consequence, we have to cut the grass as carefully as we do our wheat, and one week will now dry up the field faster than a month used to do. We had a severe drought in Erie county this year, it commenced in June and lasted until about the first of August; it was the worst drought that I have known for many years; formerly

our roads used to be wet for many days after a heavy rain, now they are often dry in a few hours.

I remember that about two years ago I passed through a large piece of timber known as the Jumbo woods. It was not far from the middle of August and the people here were finishing up their haying; they were gathering small crops and the hay was dead (dried up) and comparatively worthless as feed. We came along to a field near the woods in which the grass was as green as it was in July. We stopped to examine it and I asked the driver why it was so; he stated that he did not know but that this field never dried up like the others. The woods adjoining it was about four miles square and there was the secret of the whole thing; the moisture was blown over into this meadow. Underdrainage makes quick returns to the man who drains, but is a bad thing for the man who does not. Of course I would drain all the low places and slough holes. Underdrainage has many benefits, but it also has its disadvantages.

R. S. SEARLE. I wish to correct the idea which Mr. Powell has of the drainage which I have advocated; I am as much opposed to draining the water down hill as he has; I propose to put it down in the subsoil and keep it there until it is needed, and then it will again come to the surface by capilliary attraction when it is most needed; our ditches catch and hold the surplus water.

G. HIESTER of Dauphin. I wish to get back to our original question (that of growing fruit). Orchard planting is not as expensive as many seem to suppose, it only requires an expenditure of sixty-five dollars to plant ten acres with peach trees; while these trees are growing, you can raise full crops on the ground. I have grown fine crops of raspberries and did not lose one foot of the ground by the trees being there. Trees of three or four years growth make but little shade; if followed in this way but little capital is required to start an orchard of trees. You can grow a full crop of strawberries for five or six years in a peach orchard.

J. A. HERR of Clinton. The first cost of the trees and orchard is not great; but does it pay to cultivate every year? Many of our farmers do not like to meddle with them because they cannot use their farm machinery in the orchard; but it is not necessary to crop it, it will pay to keep on fertilizing it and raise trees only; you get better results in the trees but it may not pay as well in dollars and cents as the mode proposed by Mr. Hiester. But we cannot all sell our berries in as good a market as he can, and of course cannot realize as much profit as he does; where fruit will not pay we can raise trees only and will get even better results when they do begin to bear. One trouble met with in fruit growing is that many of our farmers rent the farms which they work; a fruit farm should be under the care of its owner, for its future needs constant guarding and vigilant care; an error once committed cannot be rectified for many years. In the aggregate it requires a good deal of capital for a poor man to work up into a good and paying fruit farm; the first cost on the trees is one of the smaller items. A tenant will not do it for he may not remain long enough to reap the benefit of his labor and expenses.

G. HIESTER. I would like to know why it is that a healthy and growing tree will not bear a good crop of fruit every year instead of every other year?

Secretary EDGE. I think it may be accounted for by the following reason: During the past year the trees had not only to perfect their

crop of fruit, but also produce the crop of fruit buds for the crop of the next season; both duties, when one is overdone, are too much for the tree, and the crop of fruit-bearing buds for next year is short; next year a short crop of fruit will enable the trees to perfect a large number of fruit buds for the succeeding season, and thus the rotation is kept up; one duty or the other must suffer from the overstrain; the fruit is on the tree and has the first chance; it is perfected, and the buds for the next season suffer in proportion as the crop succeeds.

R. S. SEARLE. I have a Bellefleur apple tree which, since 1869, has not failed to perfect a good crop of fruit every year; other trees in my orchard have not done this. This is the third year in succession that we have had heavy crops of fruit.

Dr. W. S. ROLAND of York. About twenty years ago I planted four trees of the Tallman sweet apple; for fifteen years one of them has never failed to produce a crop; the other three were from the same lot of trees, and planted at the same time on apparently the same soil, yet they only give me a crop once in about three years. Of a lot of twelve seedlings I did not have three grafted; one of these produced pretty good fruit, but the other two were worthless.

J. A. HERR of Clinton. I am never without apples in my orchard every year; but certain of the trees bear one year and others the next; the fertility of the soil is all right in both cases; it is all fertile enough.

Mr. DAVIES. The gentleman states that some of his trees bear one year and some the next, so that he is never without fruit. I have a tree both sides of which are grafted with the same kind of fruit; one portion of the tree bears one year and the other the next, and so on in regular rotation. There is a little something about all of these things which none of us are quite able to solve. I have trees that bear every other year, and some that bear every year, but I have never had any one to explain it satisfactorily to me.

A. C. WARREN of Susquehanna. I have two trees of Golden Sweet apples in my garden; both bear the same year and both bear every other year; but from some unexplained cause one year but one of them bore; the next year the other one bore and since then they have been keeping it up alternately. I also have a tree one half of which bears each year; it used to bear all over alike and the same season.

E. REEDER of Bucks. I have a great variety of apples, but with the exception of Smiths' Cider, I have no kind of tree which bears every year.

L. B. SPEAKER of Sullivan. I think that the bearing of peaches, and probably of apples too, may be regulated to some extent by putting saw dust around the trees as far out as the branches extend; we are rather too far north for peaches, but this plan keeps the frost in the ground and retards the blossoming until we have warm weather and with little or no danger from late frosts; the Northern Spy bears with us every year and we depend largely upon it and the Baldwin.

B. C. CAMP of Susquehanna. What is the best way to dispose of our apple crop at this season of the year? All of us have a surplus. What shall we do with it now, to realize the best returns from it?

Mr. REEDER. Barrel the apples up and send them to the south eastern part of the State.

Mr. R. S. SEARLE. Barrel them up and give them to the railroad company for the freight. But I have an application for all of the apples we have here this year if we can only get the railroads to carry

them to market at rates that will allow us something for the apples; you will have no trouble in getting one and one-half dollars per barrel and pay for your barrel, if they are good winter fruit. I have in my pocket now a letter from a gentleman who wants some apples and if you have enough to make a car load he will take them at fair prices; the best rates on the railroad is about sixty cents per barrel and they are worth two dollars per barrel in Philadelphia.

B. C. CAMP. My question was intended to develop the best way of disposing of them now; we are feeding them; I have three hundred gallons of good vinegar; what shall I do with the other four hundred bushels, which are fast going to waste?

M. W. OLIVER of Crawford. I am shipping apples from Conneautville to Pittsburgh. I am getting one and one-half dollars per barrel in the orchard for them; the freight is thirty cents per barrel, so that I am getting a fair price for them.

R. S. SEARLE. I use a crate made of common boards; the sides are of lath; they are thirteen by fourteen inches and just hold one bushel; they cost me about five cents a piece; I find that I can keep them in this way better than in any other shape; I keep them in a cool place until there is danger of freezing and then move them into the cellar.

H. H. COLVIN of Lackawanna. I can give general prices in Scranton. Mr. Porter bought five thousand barrels of one man; they were delivered at Deposit and were paid for at the rate of one dollar and five cents per barrel; this supply will last Scranton about one week and not longer.

B. C. CAMP. We cannot get barrels here except such as our store keepers buy sugar in and these are too large; they hold over three bushels; to fill these and deliver them on the cars at one dollar per barrel, would not give us much of a price per bushel. I think Mr. Searles' idea of a rough board and lath crate is a good one.

R. S. SEARLE. The crate alluded to would do, but if I was going to ship them I would make them larger—say half a barrel in measure.

J. A. HERR of Clinton. The apple barrel is of a standard size, and the crate is of indefinite size. I sell my apples in barrels, some of which hold four bushels, but I sell them as four bushels and not as one barrel; I sell the barrel for just what it holds, not more or less. I have been over some of the southern and south-eastern counties of the State, and I know that there is a great demand for apples there.

Secretary EDGE. Much of the fruit now coming into the Philadelphia market is shipped in crates. They are made somewhat larger than Mr. Searle has stated—say 12x13x24 inches, with a division of inch boards in the middle; the ends and the middle division are of inch boards—say 12 to 14 inches square, and the tops, bottoms and sides are made of heavy plastering lath or strips of similar size cut on purpose. I do not think that it will be long before the Philadelphia market ignores the barrel entirely. The crates are so much more convenient, and a given amount of fruit can be more rapidly and easily handled in this shape than in any other.

Potatoes can also be very conveniently handled in these crates, they may be sorted in the field and put into the crates, they can be piled up on a wagon and can be placed either in cars or cellar as wanted; a hundred bushels can in this way be handled in the least time and with less damage to their contents. If piled up closely in the cellar,

either in case of fruit or potatoes, the air can circulate through and among them, and they can be marketed at any time that may suit.

All but the three top slats may be nailed on when the crates are made; these can readily be nailed on when they are filled. The pressure of the knee will prevent bruising the contents when being nailed on.

R. S. SEARLE. A box 12x13x16 inches in the clear will give 2,496 cubic inches, this is about a bushel of apples allowing for heaped measure, the net bushel being 2,150 cublic inches.

R. S. SEARLE. I hired a carpenter one day for two dollars and boarded him; he made twenty crates. This would make the cost about five cents a piece. The lath, if sawed on purpose, should be scant one-half inch thick and one and one-half to two inches wide. The partition suggested by the Secretary is a good idea, and the crates can then be made longer and larger, the partition acting as a brace to stiffen them.

FRUIT CULTURE FOR PROFIT.

By G. HIESTER, *member from Dauphin.*

The fruit industry is commencing to attract considerable attention from the better class of farmers in Pennsylvania, owing to the fact that grain growing and general farming are not so profitable as they were before we had such a perfect system of railroads connecting the fertile plains of the great West with the seaboard. We are all looking anxiously for some crop that can be grown with profit.

It is well known that every line of business is attended with more or less risk and uncertainty, and that success in every department of life depends largely upon the man. The cultivation of fruit is no exception to the rule; indeed the chances of failure and loss appear to be more numerous than in almost any other legitimate business; nothing is certain, no rule is infallible, no rule of action can be laid down that will fit every case; these will vary according to the variety of soil and climate, and the location as regards distance from the market, that is whether the fruit can be hauled direct from the farm to a good retail market, or must be shipped to some distant point for sale.

I propose, therefore, to make a few suggestions of a general nature for the benefit of those who think of embarking in the business, in the hope that by so doing I may start discussion on this important topic.

1. Be sure that you are qualified by nature for the business. "Plod and Pluck" are two very important elements in the character of the fruit grower. It is impossible from the very nature of the business for any one to make a fortune in a few years, and he who adopts this as a calling must look largely to the future for his reward. He must be willing to work hard, observe closely, wait patiently for results and not be discouraged if, after years of careful nursing, his pet orchard does not realize his expectations.

All our successful fruit growers are men of dogged perseverence, untiring energy, and fully in love with their work, whether profitable or not. If you choose this branch of farming because you want to have an easy, comfortable time you will make a great mistake. If you be-

stow little thought and little care on your plantations your returns will be correspondingly small, and will increase just in proportion to the amount of judicious care you give them.

2. Be careful to start right. On this more than on any one thing does success depend.

Most young men start life on the home farm, where their father has worked before them, and for this reason are not able to select their location with regard to the kinds of fruit they would like to grow, therefore it is of the utmost importance that they select such kinds of fruit as are suited to their farms. While there is not any place in Pennsylvania that will grow all varieties of our native fruits in perfection, there are very few farms in any part of the State that will not grow a full line, ripening from June to November, if the varieties are selected with a view to their adaptation to that particular spot Right here I would say, never, under any consideration, buy your trees from a traveling agent unless you are personally acquainted with him and know him to be a man of strict integrity. You can get the address of a dozen reliable nurserymen from the advertising columns of any agricultural paper, and you will find it greatly to your advantage to deal direct with headquarters.

Touch high-priced novelties lightly, unless you have time and money to spare, and your inclinations run in the direction of experimental work; there is generally more profit to nurserymen than to growers in this class of trees and plants.

Select such varieties of apples as bear uniform crops of smooth, high-colored fruit (not in the tree agents catalogue, but in the orchards, yards and gardens of your near neighbors). The principal trouble with all our best varieties is that they drop their fruit before it has matured. On examination it will be found that every apple so dropping has been stung by the codling moth and contains a worm at the core; it is this that causes them to drop. The fault cannot be corrected by importing new varieties; it can only be done by destroying the apple worm. The best way to do this, I think, is to pasture the orchard with sheep and hogs; they will eat the defective apples as soon as they fall, and the worms will be destroyed. If the growers all over the State would wage this kind of warfare against the apple worm, in a very few years his numbers would very materially decrease and the yield of perfect fruit be proportionately increased.

Select such varieties of pear as hold their foliage late into the fall in your immediate neighborhood. It is impossible to grow a good flavored pear on a tree that drops its leaves when the fruit is half grown. Feed your trees well; you cannot make your ground too rich for pears. At a recent meeting of the State Fruit Growers' Association a gentleman was asked how he always managed to exhibit such magnificent pears. "Well," he said, "I have a hog pen under the two trees that bear these pears, and I think any of you gentlemen can do just as well if you will put a hog pen under each tree."

If varieties are selected which are at home in your soil, I think this will prove to be the most profitable fruit, although the introduction of the Kiefer, Lawson, and other hybrids of the sand pear, has undoubtedly hurt the pear market and taken money out of the pockets of the fruit growers, while it has greatly enriched the nurserymen, who were so fortunate as to hold a large stock when they first appeared.

Plums cannot be grown on open farms in any part of the State that

I have yet heard of, owing to the ravages of the curculio. Although numerous remedies have been devised, none of them are practicable, as the cost of applying them exceed the value of the crop.

Peaches have proved very unsatisfactory of late, owing to the short life of the tree. I think, however, the failure has been largely due to a lack of knowledge on the part of the growers of the habits and needs of the tree.

Almost every grower plants half his orchard in early varieties, which do no good, and seeing this he becomes careless and allows the borer to get into his trees, and in a very short time we hear that his orchard has died of the yellows. I firmly believe that nine-tenths of the so-called yellows that we hear so much about is nothing more than the damage caused by the borer. By this I do not mean to say that there is no such disease as yellows, for every experienced grower knows that there is, and knows also that the only way to prevent the spread of the disease, is to dig out every affected tree as soon as discovered, and burn it root and branch. But I do mean to say that more trees are destroyed each year by the borer than are killed in ten years by yellows. This is no new doctrine, but has been repeated time and again by lecturers and writers on this subject. Notwithstanding this fact, we find growers every year allowing their trees to be destroyed, while they look calmly on and talk about the short life of the peach tree as compared with the same tree forty years ago, instead of going to work with their knives and cutting out the borer, thus adding years to the life of their orchard. I would, therefore, say with regard to the peach, plant only late varieties—none that ripen earlier than the middle of August. Select strong one-year-old trees with straight clean stem, well branched roots and collar perfectly free from worms. Many nurserymen rub a handful of ground around the collar of a tree that has been eaten by worms, and thus cover up all traces of them, so that the defect will not be noticed unless the trees are very carefully examined; it is well to discard all stock so treated. Keep your trees free from the borer by carefully examining the collar just below the surface of the ground twice a year, in May and October, dig out every worm and scrub the wound well with soft soap. Work your orchard in hoed crops three or four years, after that work without crops. Manure with commercial fertilizers rich in potash and phosphoric acid, dig out every tree that shows sign of the yellows as soon as discovered and the chances are you will have profitable crops of peaches. Grapes are very easily grown and are being more generally used each year. The Concord still stands almost alone as a profitable market sort for Pennsylvania, although Moore's Early appears to be growing in favor. They should be planted in rows eight feet apart each way and given good clean cultivation ; they will begin to bear the second year after planting and will be ready to yield a full crop by the fourth year. The methods of pruning and training are quite numerous, but the one most generally adopted in our section is the horizontal arm system, with the young bearing canes trained vertically and tied to a trellis consisting of four wires stretched upon strong posts set eight feet apart along the row. Whatever mode of training is adopted the following general rules for pruning should be observed (These rules were given many years ago by Thomas, in his work on fruit culture, and have never been improved on) :

First. " Allow no shoots to grow nearer than one foot of each other."

Second. " Cut back each bearing shoot at the close of the season

to one strong eye, as near the old wood as possible, to produce bearing wood for another year."

Third. "Rub off as soon as they appear all shoots not needed. These rules may be observed for different modes of training and will succeed well."

Use fertilizers consisting principally of ground bone, and avoid the use of barn-yard manure entirely. The price of grapes has been very low lately, and there is no prospect of an improvement in this respect as the acreage is increasing each year; but, since the price has reached a point that is within the means of the masses, the demand appears to keep pace with the supply; and as a well cared for vineyard will yield two tons or more of marketable grapes per acre it will be readily seen that at the present low price they will pay better than wheat or corn.

We now come to the small fruits, which are generally considered the most profitable, partly because they can be grown between the trees in the young orchard and partly because we do not have to wait so long for a return as from the fruits just enumerated.

The strawberry stands at the head of the list. It is universally recognized as the most delicious fruit that grows; it finds its way alike into the palace of the rich and cottage of the laborer. The methods of growing it have been reduced to such a perfect system that it can be sold at a price within the reach of almost every one, and this fact makes the demand almost unlimited. The small varieties can be grown more cheaply and are surer croppers than the larger cnes, and for the careless grower would be most profitable; but the progressive, wide-awake farmers of Pennsylvania always want the best, so we find very few small berries grown in this State. To produce fine large berries, have your ground very rich and keep perfectly free from weeds, either with the cultivator and hoe or by hand weeding or all three combined as the case may require, and as soon as the ground is frozen in the fall give a dressing of fine stable manure on the rows; this will serve as a slight protection against sudden changes during the winter and early spring and give nourishment to the plants when they most need it to drive a good supply of fruit stalks for the first seasons crop. Have a good supply of crates and boxes on hand before you commence to pick, as the berries must be gathered and marketed just when they are ripe, and one or two days' delay in the height of the season, occasioned by scarcity of boxes, may cause very serious loss and derange all your plans for the remainder of the season. Employ only careful pickers, and have a reliable man always in the patch to oversee them and note that they do not put defective or mashed berries in any part of the box, as one or two bad berries will spoil a whole box in a very short time. Have some kind of a shelter erected in the patch to protect the full crates from the action of sun and wind until they can be sent to market, and do not hold them an hour longer than is necessary after they have been picked.

Raspberries can only be grown in the neighborhood of a good retail market; the fruit is much softer than the strawberry, and having no hulls to keep the berries apart they pack very closely in the box and are apt to mold if handled at all roughly by the shippers.

The first question therefore to decide is, have you a good home market for your berries, that is, a market within one hundred miles, with a night train to ship on? If so, there is no reason why you should not

succeed if you exercise proper watchfulness and care in the picking and packing.

After fruit has been grown it must be marketed, and here is where so many fail, they can grow fine crops of fruit, but are unable to dispose of it with profit. There is no business where strict honesty will pay better than in this. Be careful to grade each basket uniformly throughout, so that by a glance at the top of the package you may know exactly what it contains. Use only clean new packages, and stamp your full name and address on each, it is the best advertisement you can have. Never consign your fruit to a commission merchant if you can sell it outright—it is much better to sell direct to the retail dealer, as by so doing you save one profit of at least ten per cent., and, by keeping your business in your own hands, you can, in a measure, control the price of your goods. Keep posted as to the value of fruit, not only in your own market, but in all sections that may possibly affect you. Put a price on your goods, based upon your knowledge of the market and the quality of the sample; if your fruit is strictly first class, put a first-class price on it and stick to your figure, but be careful never to charge the highest market rate unless you know that the article warrants it. Never sell to a dealer whom his banker will not recommend as prompt and reliable. Keep a careful account of all baskets and other packages, and insist upon their prompt return or immediate payment for the same. Send your bills promptly, at short intervals—once a week at longest—and insist upon payment being made when bills are sent; do not hesitate to refuse to deal with any one who will not agree to these terms. Never hesitate a minute to make a reduction in your bill for fruit that has reached its destination in a damaged condition, this will sometimes happen to the most careful, by reason of hot, murky weather, or other unavoidable causes. Let your fruit always be exactly what you represent it or no money asked; treat your patrons fairly and honestly, and require the same treatment from them in return. By following these few suggestions you will have no trouble in building up a trade for all the fruit you can grow.

INVESTIGATION OF DISEASES AMONG DOMESTIC ANIMALS.

By the SECRETARY.

Under the provisions of the act of June 2, 1887, the Board of Agriculture is empowered to investigate outbreaks of disease among the domestic animals of the State, and to take such steps as may be deemed advisable to prevent the spread of any disease. The appropriation granted by the act is specifically for the following purposes, as stated in the act itself: "For the actual and necessary expense of preventing the spread of disease among domestic animals (not otherwise provided for), and for investigating the same."

Under the provisions of this act, and in accordance with the act forming the Board, the Secretary, assisted by Dr. F. Bridge, the Veterinarian of the Board, have carefully investigated a large number of outbreaks of disease, the symptoms and surroundings of which

seemed to give them especial cause for fear of a spread to other animals. In this investigation it was assumed that it was not the intent of the Legislature that any cases of a well authenticated and well understood disease should be investigated. In fact, aside from this reasonable view of the wishes of the Legislature, the small amount granted for this expense entirely precluded an examination beyond the leading cases which have been brought to our notice. In many cases reported no examination was made, because the symptoms as given by our informant enabled us to distinctly recognize the character of the disease, and to prescribe remedies without the expense of a visit from either the Secretary or Veterinary Surgeon. In many cases the visit of the Secretary was all that was necessary (in the absence of a plain diagnosis of the case) to enable us to give such advice as was needed to allay all alarm.

A large number—much greater than usual—of Texan or southern fever cases were investigated, and it was not thought to be necessary to assume the expense of investigating a large number of other similar cases which were from time to time reported. In such cases, the symptoms having been plainly given, prescriptions were forwarded and advice given which enabled the resident surgeon to control the outbreak, and in many cases the advice and assistance thus given have saved much expense to the owners of live stock. Two such outbreaks might be specified in which the visit of the State officers was the means of saving stock of a much greater money value than the whole amount of the appropriation granted by the Legislature. In a number of other cases the information given by the Secretary and Veterinarian of the Board allayed local excitement and contradicted newspaper rumors, which, if uncontradicted, would injure the live stock trade of the whole State.

In a number of cases outbreaks of Texan or spleenic fever were reported by newspaper correspondents and telegraphed abroad as losses from contagious pleuro-pneumonia, and in this way nine-tenths of the reported outbreaks of the latter disease were false in every particular. This condition of affairs, and the willingness of unauthorized persons to class all unknown diseases under the one head of contagious pleuro-pneumonia, has done much to cast discredit upon the live stock interests of our State, and to give the impression that those who have the suppression of this disease in charge were very remiss in the performance of their duties. In some of these cases the manner in which the reports were circulated and the repeated circulation from the same person clearly showed that it was for a definite purpose. In many such cases, without the author having taken the trouble to make even a casual investigation, the State officers have been very severely and unfairly criticised. In such cases we have rested satisfied that in the end the right would triumph and justice be done to us. The result, so far as the practical stock owners of our State are concerned, has always justified this belief, and in the end has proven that the action as taken (with a full knowledge of the surrounding circumstances) was correct in every particular.

The outbreak of any unknown, or not properly understood, disease in a neighborhood naturally excites and alarms the owners of surrounding stock. An outbreak of Texan fever, by which one-third of a herd are lost, will very naturally cause alarm, especially when the resident practitioner has not met with the disease in his practice and is not therefore familiar with it. In such cases it is but natural that surround-

ing stock should be removed and the utmost care taken to seclude them from the fancied danger of contagion. In such cases a visit from our Veterinary Surgeon allays all fear, and at the same time prevents a greater loss to the owner of the infected herd. In such cases, the writer has found the owners of live stock, secluding them upon inconvenient portions of their farms where all the drinking water had to be hauled to them and many items of expense incurred were worse than useless.

It is a matter of pride to us that in no single case have we had any difficulty in obtaining the consent of the owner to any measures which we might deem expedient for the protection of his own or surrounding animals. In one case it was deemed safest to slaughter every animal in a herd infected with tuberculosis. A meeting of the neighbors was called and the matter fully explained. All the animals were slaughtered under the supervision of a committee and the diagnosis of our surgeon confirmed in every case. This action upon the part of the owners is all the more creditable when we take into consideration the fact that the limited amount of the appropriation and the wording of the act did not warrant us in paying anything for the animals thus destroyed.

After ten years of practical experience with disease among the live stock of our State, we unhesitatingly assert that no equal amount appriated by the State affords as great benefit to the class most directly interested, as the small annual amount given the Board for the purpose quoted at the commencement of this article. In single cases we have been enabled to save the unfortunate owners from a pecuniary loss even greater than the total amount of the appropriation, and when we take into consideration that many such cases are investigated each year, the importance of the work is very evident.

The only negative feature which the State officers meet with in connection with this duty, is that they are not able to investigate more than one-third of the cases annually brought to their notice, and in the selection of cases for investigation, care has been exercised to so distribute the work as to confer the greatest good to the greatest number; thus, in many cases where we would have been very willing to have visited the herds, we were unable to do so from want of funds available for the actual expenses of the work. In several cases we have no doubt caused hard feeling by a failure to investigate cases which, to the parties directly interested, were no doubt of great importance, but in which the character of the disease was well understood and its treatment was clearly within the ability and province of the local practitioner. In several cases in which outbreaks of disease, which the symptoms furnished clearly showed to be Texan fever, were not investigated, because: *First*, the funds at our disposal would not admit of further expenses at that time; and *Second*, Because we had already investigated and reported upon a large number of cases of the same disease. But in all cases such advice was given as would enable the local practitioner to perform the same service as would have fallen to our surgeon had he visited the herd. That all reported cases cannot be visited is perhaps unfortunate, but it should be remembered that it was not the intent of the Legislature that the Board should attend all the cases of sickness among the live stock of the State, but that the appropriation was intended for the investigation and care of cases not thoroughly understood and which might possibly be contagious and dangerous to the stock of the neighborhood.

In the following pages we give a brief outline of some of the cases which have been investigated; this of course should not be understood as embracing all of the cases visited, nor even to include all of the leading ones. No mention is here made of cases of tuberculosis, and yet they are not only the most numerous but also by far the most important to the surrounding live stock owners and to those of the whole State. We have only attempted to give the result of investigations of disease not fully reported on in former years, and which, from their surroundings, seem to be entitled to more than ordinary notice. The summary presented by the tabulated report of our Surgeon shows the extent of the work, and a perusal of this table will convince all of the great importance and low cost of the service rendered to the stock owner by this division of the work of our Board.

When the reader is reminded that this work has been going on in a quiet and practical manner for the past nine years, the importance of continuing, and even enlarging it in the future becomes apparent. If the limited amount thus granted us can be used so as to so well protect the welfare of our live stock interests, there can hardly be any good reason urged against its reasonable increase in the future.

Black Quarter or Black Leg.

This is but one of the several forms of anthrax diseases, of which spleenic apoplexy may be taken as another type, which owe their origin to defective drainage, impure or insufficient water, high feeding, sudden changes of temperature and to exposure to the hot sun. They are due to the presence in the blood of a minute vegetable growth known to scientists as *Bacillia anthracis*. The causes which we have enumerated above may, any one or more of them, cause an increase of these bacillia in the blood and thus cause the symptoms which characterize this class of diseases. When the brain and nervous system is the point of attack we have spleenic apoplexy. When the neck and fore quarters are attacked we have "black quarter" or "black leg." In horses it produces the dreaded plague of the Siberian steepes; in swine it appears in the form of "black tongue" and malignant sore throat. All are due to a similarity of cause, and a remedy can only be attained by an examination into the cause and its immediate removal. In the case of animals this is most quickly attained by an entire change of pasture; a removal from low and swampy pastures to high and dry ones. As to whether the special form which we have under consideration is or is not contagious, authorities differ. The fact that a number of animals in the same pasture will develop the symptoms at the same time and that they will gradually spread to others *in the same pasture*, does not necessarily prove contagion. If the so-diseased animals are at once removed to other pasture and brought in contact with animals which have not been subjected to the same causes, we do not find the disease to spread. If it was of a contagious nature, we would find that having been originated in the low pasture it would, from the diseased animals, spread to animals in better drained pasture. But this is not the case, and hence we may infer that the duplication of symptoms was due to the fact that all had been subjected to the same disturbing causes and not to contagion.

The symptoms and post-mortem appearances are thus given by Dr. Hill: "So rapidly does the disease run its course that frequently no indications of illness are observed, and much consternation is displayed at finding what appeared to be a healthy animal the night

before, dead before morning. Stiffness and swelling are the symptoms generally first noticed, affecting the fore or hind quarter (hence the term quarter evil). This swelling, which is at first hard and tender, becomes soft and puffy, and if the fingers are pressed over it a crackling noise is produced, due to the presence of gas in the areolar tissue, given off from the stagnant and decomposed blood. The pulse is rapid, weak and nearly imperceptible; eyes red, visible mucous membranes injected, with ecchymose spots thereon, respiration labored and painful, continual moaning, and extremities cold. These symptoms rapidly increase in intensity, mortification sets in and death closes the scene.

"When the skin is removed the vessels, chiefly at the affected part, are observed to be distended with blood, which is black and putrid, some of which has escaped through the walls of the vessels into the loose areolar tissue and emits a most offensive smell. The mucous and serous membrane generally are found more or less congested with extravasation of blood in them. This congested appearance is exhibited in most of the internal organs, thoracic and abdominal. The vessels of the brain are in the same condition. After death putrefaction takes place in the whole carcass."

The rapidity with which the attack usually runs its course precludes the successful application of remedies in most cases. As before indicated, the first step in controlling the outbreak is to remove the cause by a change of pasture and entire change of food and treatment as far as is possible.

In the earliest stages of the disease bleeding may be an advantage, but at the stage at which such outbreaks are usually noted, it is worse than useless and calculated to increase rather than remove the evil. Dr. Hill recommends doses of the following: Spirits of æther nitre and tincture of gentian, each one ounce, given in gruel; sulphate of iron twice daily, in half ounce doses, in ale or brandy and water. Professor Williams advises doses of chlorate of potash, three drachms to a full grown animal. All, however, agree that "An ounce of prevention is worth a pound of cure," and that the true plan is not to expose young stock to the danger of the disease during July, August and early September or until excessively hot weather has lost its power to create and nourish miasmatic diseases, of which black quarter is but a type.

Bronchitis.

This disease is seldom met with in an unattended form, and it is usually found in connection with catarrh or ordinary pneumonia. The most notable case to which the attention of the Veterinary Surgeon of the Board was called during the past year was at Strinerstown, near Goldsboro', York county. Our attention was called to it from the fact that the attending surgeon pronounced it to be an outbreak of contagious pleuro-pneumonia. At the time of Dr. Bridge's visit one animal had died, one other was in a dying condition and five more sick.

This disease is essentially an inflammation of the air tubes, whic ramify the lungs in all directions, and is usually found in connection with or closely following cases of pneumonia, which is a disease of the substance of the lungs, and is accompanied by bronchitis through sympathy; it is usually due to sudden changes from warm to cold air, or from pure air to an atmosphere which is impure or is loaded with foul odors or vapors. In cases of badly ventilated stables it may, and often does, assume the form of an epidemic, inasmuch as it will sud-

denly show itself in a large majority of the animals in the stable. This fact has caused many to confound it and ordinary or sparodic pneumonia with the disease known as contagious pleuro-pneumonia, or "lung fever."

Inasmuch as it affects organs which can have no rest, and whose work is incessant, it, if it involves any great extent of surface, becomes a dangerous disease, and from the surroundings is very difficult to reach by medicines. The first duty is of course to remove the cause, for, until this is done, all treatment is futile. If it proceeds from an attack of sparodic pneumonia our attention should be directed to the removal of this disease.

Dr. Hill thus describes the symptoms of bronchitis: "Bronchitis is usually preceded by a short tight cough, accompanied by increased respiration with more or less febrile disturbance. As the disease progresses, the feverish symptoms increase, the nose is dry, the heat of the skin is increased, the breathing wheezing, more difficult. The cough is frequent and painful, and is suppressed by the sufferer as much as possible; movement agravates it and causes distress. At first a limpid discharge issues from the nostrils, and this subsequently becomes thick and more copious, and ultimately muco-purulent. The eyes are inflamed and the pulse considerably accelerated, and unless speedily relieved suffocation terminates the case. The animal loses all appetite, and the emaciation is rapid during the progress of the disease. The skin is hide-bound, the coat harsh and staring and the belly drawn up."

Dr. Law notes as a peculiarity of this disease that "Precussion detects no change of resonance at any part of the chest as in pneumonia."

Dr. Bridge recommends the following in the line of treatment: "Tincture aconite and tincture verat vird of each one ounce, alcohol four ounces, extract belladonna one drachm and aromatic spirits ammonia four ounces; dose a tablespoonful three times each day."

Dr. Hill, in referring to treatment, writes as follows: "Warm demulcent drinks should be allowed. Milk is best adapted to calves; gruel, linseed tea and barley water for more mature animals. The bowels, if necessary, should be relieved with salad or linseed oil and enemas. Drastic purgatives should on no account be used." As stimulants to accompany proper treatment, Dr. Hill recommends "Brandy or whisky, from one to six ounces, according to the age of the patient, in warm water every three hours, and to subdue the irritant symptoms, camphor, from one to four drachms made into an emulsion with eggs dissolved in milk or added to the stimulants, will be found useful; or, chlorodyne, one to two drachms in a little oil."

Prof. Law writes: "Give frequent diuretics (nitre, sweet spirits of nitre), anodynes (belladonna, lobelia, aconite), and expectorants (liquor ammonia acetatis, oxymel of squill, guiaacum, ipecacuanha and antimony)."

Spleenic Apoplexy.

This disease has been prevalent to rather more than its usual degree during the past summer and several cases were investigated by the Veterinary Surgeon and Secretary of the Board. The increase in cases was due to the prolonged warm weather of June, July and August, where pools were depended upon for the supply became scanty and very impure; in one case investigated the only water ac-

cessible to twenty-four head of cattle was a pool covered with green scum, so situated that all the drainage of about two acres run into it; hogs wallowed in it and all the excrement and urine dropped within the two acres was washed into it by every rain that fell. When the visit was made the green scum was so thick that the animals could only get access to the water by wading out a short distance from the shore.

Under such circumstances, the loss of seven out of twenty-four head, was not at all surprising, and how the remainder kept alive during the hot days of the summer is still more wonderful; the owner did not appear to have the least idea of the cause of his loss; his father had watered his cattle at this pond before him; it was however admitted that they had, in previous years, had outbreaks of "murrain," but this was no more than was expected. Spleenic apoplexy will exhibit itself very often, especially during long continued dry weather, among cattle confined on low and swampy meadows with poor and innutritious grass and absence of shade. It will also arise from a too large supply of stimulating food when accompanied by hot, dry weather and exposure to the sun. Sudden changes of poor to rich pasture will bring on an attack and such attacks are usually most fatal. Without any of the usual surroundings of excessive heat, it will sometimes break out in high-fed herds, especially of milk cows which have been forced during the winter by high feeding. It is also met with among cattle which are pastured upon land that has been highly manured for a series of years, and is always most prevalent in the older counties of the State.

Symptoms.—The attacks of this disease are usually so rapid in their termination that the owner seldom notes anything wrong until it is too late for action. Animals apparently sound in the evening will be found dead in the morning, or so weak and debilitated as to be unable to get up or move about. In other cases the action of the disease is much less rapid and several days elapse before the dangerous period arrives. In such cases we find the symptoms accurately described as follows: "There is a cessation of rumination and loss of appetite; weakness and prostration ensues with stupor or great excitement; shivering and general or partial sweatings appear, or the skin, which is harsh and dry, is hot and cold alternately; tremblings manifest themselves; along the spine and ribs pressure causes pain; the muscles in some regions, especially those of the neck, contract spasmodically, and these contractions are often accompanied by plaintive lowings. The contractions become more marked as prostration increases; if the animal is made to move it staggers and stumbles, and progression is nearly impossible; it often falls and has great difficulty it getting up. About this period the fœtid and sanguiolent diarrhœa sets in, accompanied by abdominal pain, which the animal indicates by frequently looking at its flanks. The expression is that of stupor and the dull appearance of the eye is very characteristic; at the same time the heart-beats are loud and tremulous and the pulse is small, very quick and irregular; the temperature of the body may be high, but the legs and face are cold; the respiration, at first sighing and plaintive, soon becomes panting; the muzzle is dry and the mouth cold and filled with foamy saliva; the tongue is pendant and violet-colored, the buccal membrane yellow and the animal grinds the teeth. The abdomen becomes distended and the animal falls, blood flows from the nostrils, and the foam from the mouth is blood-colored, and

convulsions, especially of the limbs, commence, and in some animals are so severe that it is dangerous to go near them. Death, the usual result, may occur in a few hours."

Of treatment, Gamgee writes: "Many cases prove fatal whatever treatment may be adopted. Success has attended the practice of those who have aimed at moving the affected animals rapidly about, dashing cold water on their bodies and following this up by full doses of purgative medicine, with carbonate of ammonia. In the earliest stages of spleenic apoplexy bleeding may be of service. Preventive measures should be resorted to, and these consist of low diet, active exercise, purgatives and neutral salts in water."

Texan or Spleenic Fever.

This disease, which is known in different localities as Spanish fever, southern cattle fever, Texan fever and spleenic fever, has been unusually prevalent in the State during the past summer and autumn. During the months of August and September outbreaks were examined at Middletown, Trexlertown, Alburtis, Womelsdorf, Newtown, Mechanicstown, Natrona, Federal, Lock Haven, Shiremanstown and other points. A number of cases which were reported, and which were undoubtedly of similar origin, were not examined for want of time. In all cases these outbreaks were due to the purchase of "feeders," which came from the West, either by way of Pittsburgh or Buffalo. The outbreaks at Trexlertown, Alburtis, Womelsdorf, Newtown and Mechanicstown were due to infected cattle coming into the State through Buffalo; those at Natrona and Middletown to cattle coming through Pittsburgh. Other outbreaks were caused by the direct introduction of infected cattle from Ohio and Illinois.

In each case the surrounding stock owners were greatly excited, the outbreak being supposed to be one of contagious pleuro-pneumonia. This excitement was in some cases aggravated by the fact that the local veterinary practitioners were ignorant of the character and nature of the disease. This fact also greatly increased the mortality, for in many cases the course of treatment pursued was such as would greatly lessen the chances of recovery, and in one case at least was the indirect cause of the loss of twelve out of fourteen animals, a number of which might no doubt have been saved by proper management, and a number would have been much better off without any treatment at all.

In every case of an outbreak in this and former years the disease has been brought into the State by western cattle. In a few instances outbreaks have been noted within the past ten years which were due to animals from Virginia; but from the fact that by far the larger proportion of our feeders come from Illinois and Ohio, it is from these two States that we expect the infection. The period at which they may be expected ranges from the first of August until after the first heavy autumn frost. This year an outbreak was reported during the last week in July; but usually we have had very few outbreaks before the middle of August.

These facts, taken in connection with others which might be presented did not want of space forbid, furnish us with the possible remedy and show us how these losses to our stock raisers might be avoided. Cattle from the southern States showing in themselves no symptoms of the disease are driven or carried northward late in July and during August. Every northern or native animal which passes over their

tracks, or which by being placed in the same cars (after the southern animals have been removed), is liable to receive the infection, and in fact seldom escape it. The disease remains dormant for several weeks, and hence the animal may pass through the hands of several owners and the existence of the disease not be suspected. In fact, for a period of several weeks the most skillful veterinary examination would fail to detect any symptom of the disease, and it is usually not until the animals refuse to eat that anything wrong is suspected. In the cases which we have been called upon to examine this season the animals remained on the farms here for from two to four weeks before any disease was suspected or detected.

It has also been clearly demonstrated that one or two heavy frosts will destroy the germs of this disease whether they exist in the cars, in the roads or in the systems of the infected animals, and in several cases the writer has known bad cases of individual infection to improve immediately after a single frost. Animals regarded as hopeless cases in the evening have shown marked signs of improvement the morning after the frost. and their recovery has been rapid from that time.

The proper remedy, then, for these outbreaks is to have the power, by a national law, to prevent the movement of the dangerous animals until after we have had several heavy frosts in the autumn and not allow them to be moved after a date in the spring which shall insure several frosts after they are moved over northern roads, or placed in the cars afterwards to be occupied by other animals. This, and this alone, will secure us from the annual and *increasing* loss from this cause. At a line of latitude which has at least partially been mapped out, this disease is permanent and its outbreaks are possible at any season of the year. The disease is slowly being acclimated, and this line of latitude is slowly moving north each year. It is now recognized in the latitude of Richmond, Virginia. How much further it may move north cannot be predicted, but it is evident that every movement in this direction of this permanent line increases our liability to loss from infection. It is fortunate for the Pennsylvania stock raiser that this disease is not, like contagious pleuro-pneumonia, continuous in its infection. If such were the case, it would become the cause of much greater loss.

Previous to leaving southern latitudes the animals show no signs of the disease, and during their passage into and through the northern States the native southern animals exhibit no outward signs by which the infection may be discovered, and it is not until the native northern animals show the disease that the danger is suspected. Inasmuch as the infection may make no outward show until the animals which have caused it have passed away, it follows that even a few southern animals may do a great amount of injury before the cause is located. In the case which we have already noted it is quite probable that a few animals carried North may have been the center from which all of our infected herds contracted the disease.

In all cases where outbreaks have been examined by the State officers great excitement prevails. This is at once quieted by the assurance that while the southern animals may infect every northern or native animals with which they come in contact, yet these natives cannot and will not infect others, and hence the outbreak stops with the animals brought from the West and infected when purchased. If the Texans or other southern animals were brought on to our Pennsylvania farms they would, for an indefinite period, infect every ani-

mal with which they came in contact or which came in contact with any of their excretia; and any excrement, urine, &c., left in a car by the southern cattle would infect every animal with which it came in contact, and this power would only be lost after a heavy frost.

Symptoms.—The above facts as to the limited duration of the disease (from July 15 to October 1) relieve us from the difficulty of looking for the symptoms of this disease except during the period indicated. They are so well described by Prof. James Law, in his "Farmers' Veterinary Adviser," that we transcribe as follows: "There seems to be an incubation of four or five weeks, ending in an elevated temperature and followed in five to seven days by dullness, languor, drooping head till the nose reaches the ground, arched back, hind legs advanced under the belly and bent at the fetlocks, cough more or less frequent, muscular trembling about the flanks, jerking of the neck muscles, heat of horns, ears and general surface (limbs cold in exceptional cases), and impaired appetite and rumination. Soon weakness compels laying down, by choice in water, eyes are glassy and fixed, secretions lessened, dung hard and coated with mucus or with clots of blood, and the urine changes to a deep red or black and coagulates on boiling. The mucus membranes are of a deep yellow or brown; that of the rectum seen in passing dung is of a dark red as in rinderpest. All these symptoms become aggravated, weakness becomes extreme, and the patient dies in a state of stupor or sometimes in convulsions."

In several cases examined by the writer the temperature was elevated, and in one case was one hundred and eight degrees; usually it does not rise above one hundred and five. This alone cannot be accepted as a proof of the existence of the disease, as an increased temperature accompanies many of the diseases to which the bovine tribe are liable. The urine is bloody and so are the excrements. This, and the unusually rapid falling off in flesh which always accompanies attacks of this disease, leads to the inference that the blood becomes disorganized and passes through the tissues, and thus is the cause of the rapid loss of flesh which so puzzles the local practitioner who for the first time meets with a case of spleenic fever.

Treatment.—As a rule, nine out of ten attacks are fatal and treatment has little or no effect. Our whole attention should be devoted to assisting nature to throw off the disease; except in particular cases, all cathartic medicine should be avoided, because without accomplishing any good they still further weaken the animals and at a time when all strength is needed and when it is essential to recovery. In a number of cases which have come under our notice during the past and former years the actual loss was fully doubled by the use of strong cathartic or purgative doses. A post mortem usually shows that the third stomach (maniplies) is impacted and leads the practitioner to the inference that it is the cause (and not the effect) of the trouble. Cathartics follow, dose after dose, until the animal fails to rally and death ensues, often more from the presence of the medicine than from actual disease.

From the best evidence which we can obtain we estimate the losses of our Pennsylvania cattle feeders during the past summer, from this disease alone, at thirty thousand dollars, no account being taken of consequential losses, and our surgeon estimates that the result of his visits has saved at least one thousand eight hundred dollars' worth of stock from death from neglect and improper treatment.

Poison.

Early in May last Hon. C. S. Wagner reported that a disease, of a nature not clearly understood by the local practitioner, had appeared in a herd near Newville, and asked that an immediate examination should be made. A visit by the Secretary developed the following facts:

Tobias Wolf, near Newville, had lost four animals in as many days, and all of the remainder of his herd were suffering, to a greater or less degree, with symptoms similar to those which had apparently caused the death of the others. A careful examination revealed the presence of some caustic or poisonous matter, but the most careful examination of the history of the case failed to develop its nature, or to account for its presence. During most of the time all the herd were confined in a yard along the public road, and were driven twice each day to a running stream near by; for convenience, several of the animals were not turned out, and were watered in the stable with water from the pump at the house; all were alike affected, and those which had died belonged to both lots. The owner stated that in clearing up the adjoining garden, the weeds were thrown into the yard and were eaten by the cows. The fact that the animals which had not been out of the stables, and therefore had not had access to the weeds, proved weeds could have had no connection with the case. Five or six of the animals were very much reduced, and were evidently suffering great pain; the others, though showing precisely similar symptoms, but to a less degree, were also in a dangerous condition. A careful examination of the troughs, racks, meal, hay, straw and fodder used, failed to give any clue to the cause of the trouble, and as several hours had elapsed before the existence of the trouble was suspected, and at least one day before any definite action had been taken, all trace of poison administered through the feed troughs could possibly have been removed; at all events, the condition of the animals clearly proved that all (with possibly one exception) had been subjected to the same influences, and it was therefore impossible to attribute it to any cause but design to injure the owner through his live stock. A post mortem clearly showed great destruction and weakening of the mucous membranes of the rumen and stomach. In these organs and in the intestines a slight pressure with the finger was sufficient to force the mucous membrane into rolls and to detach it in layers; beyond this inflamed condition of the digestive organs, no other symptoms were noticeable which might not very reasonably be attributed to this cause, and nothing could be found in any of the organs which would afford a clue to the nature of the poison used, while no special reason could be given for the belief, the opinion was expressed that the trouble was caused by Paris green, administered through bad feeling, but nothing could be found to give proof of this.

The symptoms were, however, strongly suggestive of lead poisoning, and the treatment recommended was such as was suitable for this trouble, but no good reason could be given for the presence of lead in any form.

In its primary stages the best treatment for poisoning from lead, and in fact from any poisonous material, is by the use of purgatives, to carry the foreign material out of the system as quickly as possible. Strong purgatives may be used, and double doses of any safe purgative may be given; the great object being to get the foreign matter out of the system as soon as possible, and thus relieve the animal.

Sulphate of soda (Glauber salts) may be given in doses of from one to one and one-half pounds to full grown animals and to smaller ones in proper proportion. Sulphate of magnesia (Epsom salts) may be given to full grown animals at the rate of from one-half to three-quarters of a pound, the theory being that the sulphuric acid of the purgatives, in addition to their purgative effect, will, by uniting with the active principle of the lead, in a measure neutralize its effects.

At the time the herd was visited by the Secretary the animals had all been under the influence of the poison for a sufficient length of time for it to cause a high degree of inflammation and to have caused death (probably because they had received the largest amount) of four of the animals. Under this condition the use of purgatives was not admissible, as they would have but increased the inflammation. In their stead weak emulsions of slippery elm and bran were recommended; small doses of linseed oil (not more than two ounces at a dose, and not oftener than once in three hours) given. No more animals were lost, but several were reduced to such a low condition as to require several days for recovery.

In a somewhat similar case near Carlisle the difficulty, which was confined to five animals which were not stabled, was traced to a pot of white (lead) paint spilled by painters, and afterwards covered over with manure and litter. Two animals died from the effects of the lead, and the other three were fairly on the way to recovery (without treatment) when visited by the Secretary and Surgeon of the Board.

Dr. Hill, in his treatise on poisons, groups them into four classes, as follows:

Irritant.—Corrosive sublimate, arsenic, copper, zinc, iron, oxalic acid, ammonia, savin, cantharides, croton, hellebore, hemlock, hemlock drop-wort and water hemlock.

Astringent irritants.—Acorns, oak shoots and ferns.

Sedatives.—Hydrocyanic acid, aconite, digitalis, colchicum, yew and lead.

Narcotics.—Opium, tobacco, hyoscyamus, belladonna, camphor, laburnum, chloroform and strychnia.

In cases of very recent poisoning the best course is to give heavy doses of purgatives. In all cases doses of linseed oil are safe; in urgent cases a dose of from one pint to a quart may be given, care being taken to vary it in accordance with the size and age of the animal. Mucilagious drinks should also be given plentifully, and if necessary may be administered by drenching. The most important item is quick and immediate treatment. A delay of a few hours may cost the life of the animal, which might have been saved by the early application of linseed oil or purgatives, the whole object of treatment being to remove the poisonous materials before it is taken up by the absorbents and transferred to other portions of the system.

As a rule, animals will not eat poisonous or injurious plants; but at times we find existing a species of depraved appetite which seems for the time being to supplant instinct and to lead the animal to eat substances usually discarded. Perhaps the most common form of vegetable poisoning which we have been called upon to investigate is the disease—if it may so be termed—known as "wood evil." Early in the spring the animals are turned out on the mountain sides or into the adjacent timber, and finding but a very scanty supply of innutritious grass, are forced to eat the young shoots of the oak and other forest trees. The large amount of tanic and other acids con-

tained by these immature shoots gives them a strong astringent quality and soon cause impaction of the rumen and maniplies and unless relief is afforded, is followed by death; in two cases brought to the notice of the Board, this difficulty has been caused by a depraved appetite which caused the animal to eat this kind of material when proper food in abundance was accessible at all times; in these cases the post mortem plainly showed the presence of the undigested leaves and smaller branches. An exactly similar effect (produced by the same cause) has several times been brought to our notice where horned stock have had access to acorns in large amounts; impaction soon follows the presence of any considerable amount of this kind of food, and unless relief is at once afforded the attendant inflammation produces death.

Cattle pasturing on low lands are sometimes poisoned by eating the branches of the *Juniperus sabina* (savin), the *Helleborus niger* (hellebore, Christmas rose), hemlock drop-wort and water hemlock or "fools parsley;" in all such cases the first step should be to get the poisonous material out of the digestive organs as quickly as possible, but in accomplishing this, due consideration must be taken of the condition of the animal at the time the remedy is administered.

In a case of disease among young calves the difficulty was (by post mortem) apparently traced to the eating of ferns growing in an adjacent low lying wood lot; in another case the cause of the difficulty was apparently the eating of the common purple foxglove; in the case of a single young animal death was produced by browsing on the branches of a small yew tree to which the calf, by breaking into a yard, had obtained access.

Purpura Hæmorrhagica.

This disease, which was brought to the notice of the Board by a case reported by one of its members, is most common among young and rapidly growing stock; among calves it is most likely to affect such as are unusually thrifty and in above the average condition and flesh; it is most common where high feeding is the practice, and seldom met with where the animals are neglected. In case it is found under the latter circumstances, it can usually be readily traced to exposure or over exertion, and too rapid cooling after vigorous exercise.

The case alluded to was that of a horse, which, among a number of others was being fed up for the New York market, and among horses it is usually met with under the conditions which surrounded this case and which are thus described by the party having the animals in charge: "The horse was a grade Percheron, six years old, in good flesh and apparently in the best of health. I had been feeding him for two months without other exercise than that afforded by a walk twice each day to the water trough. We gave him about twelve large ears of corn for breakfast, the same for dinner and at night, a chop feed composed of six quarts of cut hay, three quarts of rye chop and one pint of linseed meal, with all the hay he would eat and kept his manger full all the time.

"Saturday evening my feeder noticed that the horse was bleeding at the nose, but he ate his feed even more greedily than usual. Half an hour later I led him out into a box stall, and noticed that his right front leg was somewhat stiff and considerably swollen from the fetlock to the shoulder, and that his nose above the nostrils was beginning to swell; he appeared to be uneasy and restless. It was proba-

bly three hours before a surgeon could be obtained and by that time his nose was very much swollen, and he had great difficulty in breathing; his legs were all more or less swollen, and small drops of blood were attached to the end of the hair on his right fetlock. His appetite remained good for three days and he ate greedily the small quantity of food that we thought it prudent to give him, until his jaws became incapable of motion.

"On Monday morning our regular surgeon arrived and at once inserted a tube into his windpipe and thus gave him instant relief so far as breathing was concerned. By this time his limbs were stiff and swollen, and he could use them only with difficulty; he could move his feet backward much more readily than forward. His body showed raised ridges lengthwise of the abdomen, and his head was swollen to fully double its natural size, and his nostrils were so much enlarged that he could not get his nose into an ordinary wooden stable bucket to drink. A fluid resembling blood was slowly oozing out through the pores of the skin on all of his legs, and also on the body below the shoulders and on the flanks, and he remained in this condition until he died, in seven days from the first appearance of the disease. During the first night the hemorrhages from the nostrils occurred about every half hour and at times were so violent as to threaten strangulation. Throughout, his appetite was good, his eyes bright and his ears erect. My own opinion is that the disease was caused by a system of stall feeding that is practiced by all dealers to fit horses for the New York market, which requires them to be 'hog fat."

Dr. F. Bridge, Veterinary Surgeon of the Board, thus alludes to the nature, cause and proper treatment of the disease: "The disease is of a sparodic character, and is a non-contagious fever of an intermittent type; it is due to some putrid condition or improper state of the blood. The capillaries are much affected especially those of the skin and mucus membranes and it is quite possible that other portions of the body are affected. It frequently occurs as a sequel to some debilitating disease as influenza, catarrhal fever, &c. Badly ventilated and illy drained stables and other violations of the laws of health are among the causes which produce it. For this reason purpura is most commonly met with among horses recently purchased and which come from pure country air, and are in a fat or plethoric condition. They are introduced into a poisoned atmosphere, to which they have not been accustomed nor acclimated to; the blood becomes poisoned with effete products, and loses its integrity, accumulates in the capillaries and smaller veins, and the loose and pendant portions of the body. It will frequently develop during sudden changes in the weather or temperature, but is seldom noted among horses at pasture. The blood when drawn from the body during this disease is found to be slightly coagulated; the symptoms are very characteristic and there is seldom any difficulty in detecting the disease. There is a slight swelling about the hocks, on the breast and abdomen. In the latter positions they are usually hard and abrupt and appear very quickly; in many cases the swellings have the appearance of having a string tightly drawn around them. They are sensitive to the touch, and at the least touch the animal will flinch. They appear and disappear very quickly and often give the impression that they move from one portion of the body to another. Small visicles, about the size of a pea, appear about the lower part of the limbs, on the fet locks and hocks. After a short

time these burst and discharge an unhealthy amber or purple-colored fluid which "scalds" the skin over which it flows.

The more particular symptoms are petechial spots of a purple color on the visible mucous membrane. The membranes of the nostrils may become one mass of corrupt matter, which may extend to and include the lungs. The under lip may hang pendulous, the head and nostrils much swollen, breathing difficult and animal unable to take food. It is with much exertion that he can lay down, and every motion is made with great difficulty.

In treating this disease, the first object should be to remove all producing causes. Give plenty of pure air and move to a well-lighted, roomy, warm stable. The duration of the disease is from eight to thirty days, and it usually requires about a month to entire recovery. There is great danger of a fatal termination from extravasation into some internal organ, and even into the subcutaneous tissue. To prevent the tendency to extravasation of the blood, styptics, such as turpentine emulsion or turpentine and oil, and tincture of ergot should be given. Chlorate of potash, two drachms, dry sulpate of iron, two drachms, and sulphate of quinine may be given in single doses three times each day.

If the animal can eat, a liberal allowance of good oats and hay should be given and special attention paid to grooming. The swellings should be lightly sponged with a weak mixture of vinegar and cold water. When there is difficulty of breathing, which appears dangerous, tracheotomy should be resorted to early in the treatment. With careful attention and proper treatment most cases will recover during the fourth to eighth day.

In referring to this disease, Professor Williams writes as follows: "It may safely be concluded that the causes of purpura are of a septic nature and are due to the absorption of the products of decomposition extrinsic to the body; to the severity and rapidity of tissue change within the body, either owing to a previous disease or debilitating circumstances, and their accumulation when naturally generated, owing to impairment of the excretory organs."

The causes of the disease are numerous, and may effect a large number in one stable, and thus give it the appearance of contagion, or they may only, as is usually the case, affect one individual animal. Sudden changes from heat to cold, when the body is warm, may cause an outbreak. Colds contracted after an attack of influenza (pink eye) may, while the system is debilitated, bring on an attack of purpura. Too high feeding without the proper amount of exercise is one of the most prolific causes, and its cases are among the most difficult to manage and cure. Some animals are predisposed to this class of disorders, and after two or three attacks usually prove fatal, even under the best treatment. Illy ventilated stables, especially when used for well-fed light working teams, are prolific sources of this disease. Attacks often follow the recovery from the attacks of other disease, especially when the animal is fed concentrated food for the purpose of rapidly improving its condition.

Investigation of Diseases of Live Stock.

Tabular statement showing location of herds visited, number of animals in each herd, number sick, and the number which died or were killed. The total work of the year embraced visiting 238 herds and the examination of 1,815 animals, including examinations of contagious pleuro-pneumonia, involving a distance traveled of 6,800 miles. This does not include twenty-three herds visited by the Secretary of the Board. Condensed from the official report of F. Bridge, United States Veterinary Surgeon.

Date of visit.	Name of owner.	Post-Office address.	Number in herd.	Number sick.	Died or killed.	Disease.
1886.						
Nov. 23,	S. S. Jones,	Chester,	21	1	0	Sparodic pneumonia.
Nov. 25,	J. Woods,	Lancaster,	13	4	1	Bronchial catarrh.
Dec. 9,	J. Smedley,	Middletown,	12	2	0	Influenza.
Dec. 17,	T. Preston,	Howellville,	30	10	4	Tuberculosis.
Dec. 21,	S. Gayhardt,	Rherersburg,	15	1	0	Bronchitis.
Dec. 21,	S. Wordsley,	Womelsdorf,	10	3	2	Filari..-bronchitis.
Dec. 25,	R. Steven.,	Carlisle,	8	2	1	Tuberculosis.
Dec. 25,	S. Mather,	Langhorne,	10	5	2	Tuberculosis.
1887.						
Jan. 5,	D. Scott,	Lyle,	18	1	0	Broncho influenza.
Jan. 5,	J. Wood,	Kirk,	27	10	0	Catarrhal influenza.
Jan. 18,	O. South,	Brandywine Summit,	12	1	0	Glanders.
Feb. 18,	W. Brown,	Lancaster,	12	8	0	Malarial opthalmia.
Feb. 20,	H. Townsend,	Glen Mills,	25	3	1	Sparodic pneumonia.
Feb. 21,	H. Dott,	Edgemont,	22	2	0	Influenza.
Feb. 22,	J. Myers,	Hartsville,	8	3	1	Pericarditis.
March 19,	S. Chambers,	Hartsville,	15	14	1	Tuberculosis.
March 21,	J. Slavin,	Rherersburg,	17	1	0	Bronchitis.
April 28,	W. Stewart,	Paschalville,	19	1	1	Paralysis.
May 3,	B. C. Patterson,	Churchville,	4	1	1	Tuberculosis.
May 20,	D. Gayhardt,	Rherersburg,	4	1	1	Broncho-pneumonia.
May 28,	C. S. Mather,	Langhorne,	12	12	12	Tuberculosis.
June 4,	H. Larkin,	Downingtown,	31	5	0	Tuberculosis.
June 5,	E. Bachman,	Berks county,	14	2	0	Tuberculosis.
June 12,	W. P. Shields,	Howellville,	3	3	0	Impactment of reumen.
June 13,	E. B. Lieby,	Marysville,	13	3	0	Tuberculosis.
July 5,	T. Townsend,	Edgemont,	19	1	1	Pericarditis.
July 10,	R. Barry,	Sharon Hill,	1	1	0	Tuberculosis.
July 15,	W. Wilhelm,	Womelsdorf,	12	8	0	Filarial bronchitis.
Aug. 2,	P. Werntz,	Goldsboro',	7	3	0	Acute bronchitis.
Aug. 12,	J. Young,	Middletown,	35	4	4	Texan fever.
Aug. 18	F. Gernet,	Trexlertown,	25	4	4	Texan fever.
Aug 22,	J. Thompson,	Torresdale,	10	6	4	Texan fever.
Aug 27,	C. Moyer,	Womelsdorf,	24	20	10	Texan fever.
Aug. 30,	W. Allen,	Chads Ford,	11	8	2	Texan fever.
Sept. 3,	A. Brown,	Peters' Creek,	12	8	3	Texan fever.
Sept. [illegible],	J. Blackburn,	Wakefield,	10	4	1	Texan fever.
Sept. 6,	W. Jacobs,	Glen Rock,	12	2	0	Broncho-pneumonia.
Sept. 6,	N. C. Elsbree,	Towanda,	21	9	7	Anthrax.
Oct. 25,	W. Conn,	Frankford,	22	1	1	Tuberculosis.
Nov 14,	J. Conner,	Bloomsburg,	10	4	2	Texan fever.
Nov. 15,	A. Boyd,	Peach Bottom,	20	4	2	Catarrhal influenza.
Nov. 15,	W. Grosman,	Peach Bottom,	22	2	1	Broncho-pneumonia.
Nov. 16,	C. F. Powers,	Lincoln,	22	1	1	Tuberculosis and influenza.
Nov. 16,	M. Conner,	Lincoln,	10	1	1	Tuberculosis.

Investigation of Diseases of Live Stock.

A tabular statement showing the number of animals attacked with each disease; the number which died or were killed, and the remedies prescribed in each case. Condensed from the official report of Dr. Francis Bridge, State Veterinary Surgeon.

DISEASES.	Number in herds.	Sick.	Dead or killed.	Remedies.
Anthrax, ...	21	1	7	Bleeding in early stages: Chlorate potash, ½ oz.; nitrate potash, 1 oz.; sulphate potash, ½ oz., in a quart of ale twice each day.
Acute bronchitis, . .	7	3	3	Tincture aconite, ½ oz.; tincture veratrum veri, ½ oz.; alcohol, 4 ozs.; extract belladonna, 1 drm.; aromatic spirits of ammonia, 4 ozs.; mix and give tablespoonful twice each day.
Broncho-pneumonia, .	91	8	1	Sloppy food with Epsom salts: 2 drms. each of chlorate of potash and sulphite soda three times each day.
Filaria-bronchitis, . .	22	6	5	Sulphur fumigating: Linseed oil, 1 pint; turpentine, 4 ozs.; mix and give 2 tablespoonful three times each day.
Bronchial catarrh, . .	36	5	1	Keep body warm—plenty of pure air. Give acetate ammonia, 4 ozs., three times a day; afterwards give sulphate of quinine, 25 grains twice each day.
Paralysis and ptacmia,	19	1	1	Nutritious and easily digested food: Stimulate the spine with embrocation; give daily 2 drms. powder nux-vomica and 1 oz. chlorate potash.
Tuberculosis, ...	206	42	39	All diseased animals should be promptly killed.
Texan fever, ...	126	41	39	Turpentine, ½ oz., with linseed oil, 2 oz., twice each day; sulphate quinine, 20 grs.; chlorate potash, 20 grs.; mix and give two or three times each day.
Glanders, ...	. .	. .	. .	All diseased animals should be killed.
Influenza, ...	135	18	4	Give a laxative and nutritious diet; pure cool air: Powder gentian root, 2 drms.; powder carbonate ammonia, 2 drms.; powder gum camphor, 2 drms., twice or three times each day.
Impaction of rumen, .	3	1	. .	Sulphate magnesia, 1 lb.; Barbadoes aloes powder, 1 oz.; croton oil, 15 drops; nux-vomica, 2 drms., in one quart of luke warm water.
Malarial opthalmia, .	12	8	. .	Give 20 grains sulphate quinia twice each day; wash the eyes with a weak solution of belladonna twice each day.
Pericarditis, ...	27	1	1	Apply a large mustard plaster to the left side; give 1 drm. of powder digitalis and ½ drm. of powdered opium three times each day.

THE BOVINE STOMACHS AND THEIR DISEASES.

By the SECRETARY.

In common parlance, we are told that the members of the bovine tribe have four stomachs, and for the purpose of being well understood we shall follow the custom and allude to each of the four divisions as a stomach, although the fact that digestion alone takes place in the fourth or last one proves that it alone is entitled to the name of stomach, the others merely acting as so many storerooms in which the food is properly prepared for the action and digestion of the last stomach, which communicates directly with the intestines.

As enumerated in the order of their situation they are: 1. The rumen or paunch. 2. The reticulum or honeycomb. 3. The omasum or many-plies. 4. The abomasum or rennet.

Of these the rumen is much the larger, and, when compared with the whole four, may be said to occupy nine-tenths of their size, but when compared with the bulk of all of the contents of the abdominal cavity, may be said to constitute three-fourths of its bulk. Its duty and office seems to be to receive and, to a certain extent, moisten the coarser portions of the food which are still in too large particles to go into the true or digestive stomach. In it they remain until the animal has satisfied its hunger, when it has the power of forming the contents into small pellets or balls, and, by a muscular action peculiar to the organ, force them upward into the mouth for remastication and mixing with the saliva.

The reticulum, or second stomach, is the smallest of the four divisions and in it are found all foreign bodies which obtain entrance into the digestive organs. Nails, small stones, balls of hair, &c., lodge here and produce those complicated disorders which so puzzle the veterinary practitioner. It is a popular theory that this organ acts as a guard over the entrance of the stomach proper and by its action excludes or retains all food not suitably prepared and all substances not proper for digestive action. This organ communicates with the rumen on one side and with the omasum on the other and thus forms a link in the chain of organs. The outlet into the omasum is shown in the plate by figure 10, and is known as the œsophageal groove or furrow.

The omasum in the bovine tribe is larger than the reticulum, but in goats and sheep it is smaller. Its object in animal economy does not appear to be clearly confined.

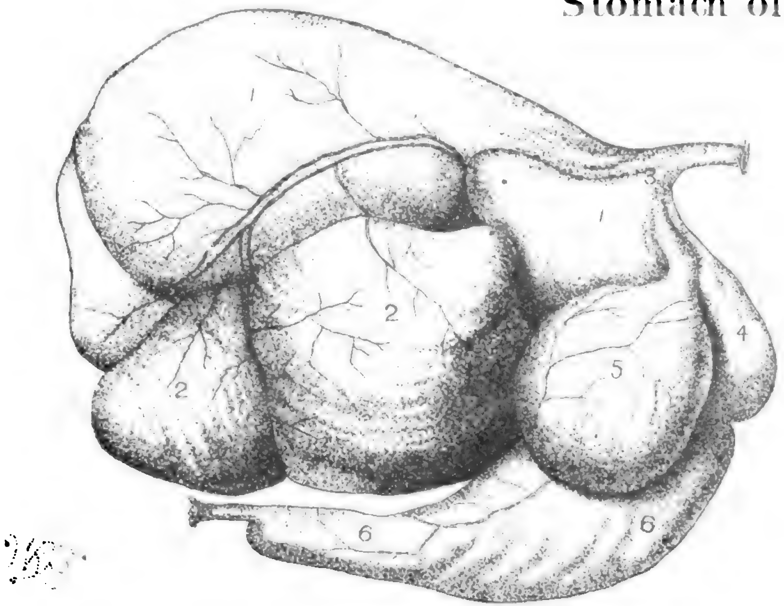
The abomasum is the second of the four organs in size or capacity and in it digestion progresses, and in it the gastric juice is secreted and mixed with the food.

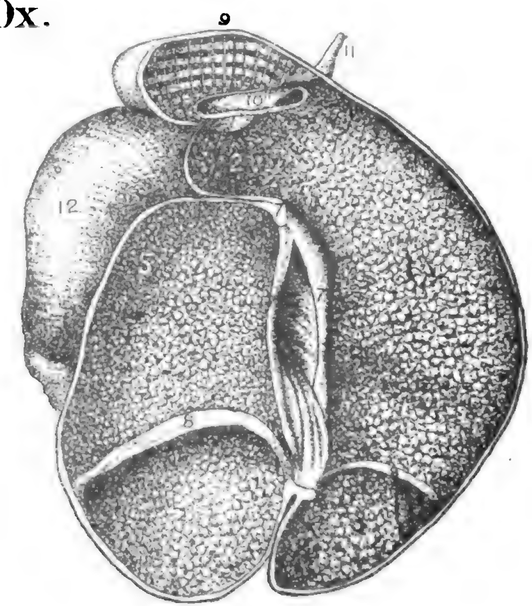
In reviewing the duty of these four organs Chaveau sums up: "The rumen is a sack where the aliment taken during feeding time is kept in reserve and whence it is again carried into the mouth during rumination after having been more or less softened.

"The reticulum participates in the function of the rumen, to which it is only a kind of diverticulum. But it is particularly with regard to liquids that it plays the part of a reservoir, the solid substances contained in it being always diluted by a large quantity of water.

"The œsophageal groove carries into the omasum the substances

Stomach of an Ox.





1, Rumen; left hemisphere; 2, Rumen right hemisphere; 3, Termination of the œsophagus; 4, Reticulum; 5, Omasum 6, Abomasum.

1, Left sac of rumen; 2, Anterior extremity of that sac turned back on the right sac; 3, Its posterior extremity, or left conical cyst; 7, Section of the anterior pillar of the rumen; 7, 7, Its two superior branches; 8, Posterior pillar of the same; 8, 8, 8, Its three inferior branches; 9, Cells of reticulum; 10, Œsophageal furrow; 11, Œsophagus; 12, Abomasum.

swallowed a second time after rumination, or even those which the animal injests in very small quantity for the first time.

"The omasum completes the tituration and attenuation of the food by pressing it between its leaves.

"The abomasum acts as a true stomach charged with the secretion of gastric juice; in this reservoir occur the essential phenomena of gastric digestion."

Impaction of the Third Stomach.

This disease is known under different names in different localities, the most common one being that of "fardle-bound." In other localities it is known as "dry murrain," "grass staggers," &c. It is due to a feverish condition of the organ and is usually the reflex of some other disease. It may, however, arise from any of the following causes: In work oxen it is often due to the entire omission of remastication or cud chewing, and in this condition is what is known to the ordinary "cow doctor" as loss of cud, a term, however, not recognized by the veterinary surgeon. Simonds thus alludes to this disease and its causes: "With regard to inflammation of the stomach, it is rather quality than the quantity of food which causes its retention, such as hay seeds, clover seeds and vetches, all of which will be retained longer than thin green meat. Provender containing a deal of woody fiber is also likely to cause it, or irregular feeding. For instance, an animal goes into pasture, gets a bellyfull of perhaps poor, innutritous food, comes up to be milked, has hay or corn, and is then turned out again; and so by this irregular way of feeding and with different kinds of food, the stomach contains partly hard dry material and partly moist, causing retention at first with partial and afterwards obstinate constipation. We, therefore, trace this disease to the peculiar office of the stomach, manner in which the animal is fed and the kind of food given. First there is a blocking up, with functional derangement, and this leads to increased mascularity, which is followed by an inflammatory condition of the organ."

Professor Law states that the disease may be caused by a deficiency of water or by a sudden change from soft to hard water. He also traces it to the introduction of lead into the system and to over-ripe hay. At different times during the existence of the Board it has been the duty of the writer to examine cases where several animals in a herd have been affected at once, and in one case where every one of a newly-purchased lot of cattle were seriously affected In each case the animals had been bought just off the cars from the West and at once turned into pasture containing large amounts of over-ripe and dry grass. Poorly fed on the cars and during their transit from the West, the animals greedily devour what they find, and the impaction follows not only from the quality of the food, but also from overfeeding. In a number of cases investigated by the writer the difficulty evidently arose from giving hungry animals hay *ad libitum*, when the same condition ensues.

Professor Law thus describes the symptoms: "Slight cases may be marked by failure to chew the cud regularly when recovering from fever, a poor appetite, dry muzzle, dull eyes, spiritlessness, quickened breathing, with a moan at intervals, roused at any time by forcibly punching the closed fist beneath the short ribs on the right side. If it has lasted several days, the fist punched into the left side may detect the contents of the pouch collected in hard masses, and tympany is

likely to be present. The dung is usually scanty and hard, but in cases occurring from fibrous or irritating food this costiveness is preceded by more or less diarrhœa. The beast leaves its fellows, reclines on its left side, with the head in right flank, and tends by and by to show palsy of the hind limbs, drowsiness and stupor, or delirium and convulsions. In more acute cases death may ensue in six hours. The animal is found apart, lying with his head in his right flank, with red, fixed eyes, eyelids half closed and much drowsiness and stupor, though he may still feed when raised, pulse and breathing accelerated, bowels loose or torpid, hardness and tenderness under right short ribs, and muscular tremors. Later the eyes glare, the patient seeks relief in motion in a straight line or to one side, regardless of obstacles, and pushing against obstructing walls and fences till teeth and horns are broken, bellowing loudly and in a terrific manner all the time."

From the situation of the organ affected, remedies are very difficult of application, and authorities differ as to the efficacy of different remedies and plans of action. Dr. Dun's mode of treatment, which is indorsed by Hill and other good authorities, is thus outlined by its author: "It consists in removing the obstinate constipation by powerful purgatives, advantage being taken to gain the utmost efficacy by combining several together and giving them along with plenty of fluid. Three-quarters of a pound each of Epsom and common salt, twenty croton beans and one dramch of calomel will suffice for a full grown middle sized cow and must be administered with three or four bottles of water or very thin gruel. In this disease there is little fear of giving too much medicine. I have known a cow to have within two days twelve pounds of Epsom salts, twelve pounds of treacle and several bottles of castor oil without effect; and it is never advisable to give small and frequently repeated purgative doses; large quantities must be administered at the outset. Their action is greatly expedited by the use of occasional stimulants which in diseases of cattle may be given without fear of endangering or aggravating inflammation. Every encouragement must be used to get the animal to drink, for large quantities of fluid are obviously essential in washing out the obstruction which causes the evil. The cessation of the grunt, the passage of some hard cakes of dung with the subsequent abatement of the fever, are the signs of amendment for which we watch."

The treatment prescribed by Professor Law is as follows: "For the simpler forms give strong purgatives (sulphate of soda, ox one pound, sheep, six ounces, with common salt, molasses and criton), stimulants (ginger, carbonate of ammonia) and abundance of watery fluids. The stimulants may be repeated at intervals of three hours and accompanied with injections of warm water. If no relief is obtained in twelve hours, repeat the purgative, and if any tenderness exists on the right side, blister it with mustard and turpentine (for sheep use ammonia and oil). If the kidneys act profusely change the purgative, giving castor or linseed oil. Even after free action of the bowels it is usually necessary to feed green food, roots or soft mashes, to give all the water that will be taken, and even add slight laxatives to ensure the perfect breaking up of all impation."

Several cases of impaction which have been brought to the notice of the Board were undoubtedly caused by turning the stock out upon rough mountain pastures early in the season, before the grass had made sufficient growth or had gained any strength; the animals were compelled to browze on the young shoots of the oak and other trees,

and the highly constipating power of this food, sooner or later, impacted the stomach. In two cases the attacks came on so nearly simultaneously in the entire herd that it was difficult to convince the owner that it was not a highly contagious disease.

In one case examined in York county, the impaction was caused by the animals eating freely of whole wheat; in another, too liberal feeding with dry hay immediately after the steers were landed from a long car ride from the West, caused a similar difficulty. In both cases the attack was fortunately taken quite early, and soon yielded to the use of strong purgatives.

In a case in Cumberland county, which involved the loss of several valuable animals, the attack was traced to the animals having had access to white paint, a pot full having been spilled in the yard and covered up by the manure. In the latter cases the attack had been so prolonged that the entire coating of the stomachs was practically destroyed, and nothing could have saved the lives of the animals.

In nearly all cases, impaction may be traced to some error in the food or feeding; to sudden changes from moist or green to dry, harsh food; from grass to harsh fodder and grain; from sound to moldy food, in fact to auy sudden change which for the time being disarranges the habits of the animal.

Gastritis, or Inflammation of the Fourth Stomach.

Inflammation of the fourth or true stomach is most common in working oxen, and is rarely met with in the feeder or in the milk cow; is usually caused by drinking large quantities of cold water when overheated, but it may, and sometime does, proceed from acute inflammation of the third stomach, to which we have elsewhere alluded.

In giving the symptoms of gastritis, Williams writes as follows: "In the gastritis of ruminations a highly disturbed condition of the nervous system is a distinguishing symptom, evidenced either by a high state of delirium, coma, or convulsive fits, indicative of disturbance of the brain proper, or by paralysis of the posterior extremities, when the area of the disturbance is limited to the posterior parts of the spinal cord. In addition to the above, the gastritis of ruminants is characterized by more or less diarrhœa, soon succeded by an apparent obstinate constipation, which, however, is not due to an obstruction of the impacted food, but to cessation of the perisaltic action of the intestines, the contents of the stomach being found generally more or less fluid after death.

"The constipation results from a loss of function, rather than from impaction, and we will do well to recommend a course of treatment calculated to overcome the seeming constipation. For this purpose, sedatives, such as aconite or belladonna, with anti-acids, bi-carbonate of soda or potash, and one, or at most two moderate doses of an oleaginous aperient, with an abundant supply of fluids for the animal to drink."

Indigestion.

This is probably one of the most common of all stomach and intestinal troubles of the bovine race, and often is the least suspected by the veterinary practitioner.

Its early symptoms are usually a depraved appetite. The animal will refuse its usual food, and will eat dung, dirt, rotten wood, leather shoes and other unsavory articles. This, however, should not be con-

founded with the habit which cows have of chewing bones, and which proceeds from entirely another cause. The hair assumes a staring and rough appearance; an unusual degree of thirst is noticeable; the animal is subject to rapidly succeeding attacks of constipation and diarrhœa. In acute cases the breath becomes very offensive, and sometimes leads the practitioner to locate the difficulty in the lungs and prescribe remedies for inflammation of these organs. In most cases the attacks of constipation are due to the presence of foreign undigested and indigestible material in the stomachs. The trouble may be caused by drinking very cold water or even tepid water to excess. Hence it is very common with working animals, or those which are only allowed to have access to water at stated intervals, and is least observable in such as have free and constant access to water. In calves it may proceed from milk too rich in fats and too poor in cheesey matters. It will often occur in cases where the calf has not been allowed to suck the first milk of its dam. In calves it may also be hereditary and be propagated from a predisposed parent.

Its most prominent symptoms are an irregular or depraved appetite, tenderness to pressure on the abdomen, a furred tongue, fetid breath and rapid loss of flesh.

Its treatment consists in the use of stimulants, as ginger, pepper, peppermint and ammonia. Some use alcohol, and it is recommended by Dr. Law.

Of treatment Dr. Hill writes: "Bearing in mind the numerous causes which operate to produce dyspepsia, our attention must first be directed to finding out its origin and to its immediate removal. In simple dyspepsia, arising from bad food and water and defective ventilation, steps must be taken to remedy each evil, and it may be necessary to prescribe tonics. The morbid appetite is best responded to by the administration of mineral tonics and tempting food."

Acute Tympanitis or Hoven.

This trouble of the first stomach or paunch is so common as to be familiar to almost every stock owner, and yet but few are able to prescribe the proper remedies. Of all the diseases of the stomach this is the one which demands immediate and rapid treatment; a short delay may involve the loss of the animal. In England this trouble is variously known as "dew-blown," "grass sickness" and "noove or blown." In all cases the prominent danger is in the fermentation of the large mass of food which is usually collected in the paunch; the partly masticated green grass, especially clover and green corn fodder, very soon, when assisted by the natural heat of the stomach, begins to ferment; gas is formed, and collecting in the stomach fails to relieve itself by belching, as in the human race, and its long continued collection produces a pressure upon the lungs and other organs which, if not relieved soon, produces death; by pressure upon a vein or artery, the effect is often rapid, and the damage is done before a veterinary practitioner can arrive.

It has been assumed that this difficulty is invariably caused by too rapid eating and too much succulent food, but so good an authority as Dr. Williams writes as follows: "An additional cause of retention in the rumen is found in disease of the salivary glands. Flourens asserted that from the period of feeding to that of rumination there is a constant and abundant secretion of silava which is constantly swallowed: if this is stopped the contents of the rumen become hard and

unfit for regurgitation. In this way rumination is suspended and tympanitis induced. These observations have been confirmed by Colin, who also found that if the protid ducts were opened and the secretion thus prevented from flowing into the mouth, rumination became suspended."

Any treatment to be effective must be applied as soon as the difficulty is discovered; if the case is not too bad the attention may be given to neutralizing the gases which are formed by the fermentation of the food; for this purpose there is nothing better than doses of aromatic spirits of ammonia and carbonate of ammonia, given every three or four hours until relief is given; the spirits of ammonia should be given in doses of from a half to three-quarters of an ounce, and, in bad cases, an ounce may be given at a dose; the carbonate may be given in doses of from three to five drachms, both in small amounts of warm water. There is always a danger of impaction following every slight attack of this disorder, and hence, after relief is given, small doses of linseed oil should be administered in order to avoid a clogging of the passages.

Some writers divide the cases of this disease into two classes, and prescribe a different course of treatment for each. The advisability of this is at least doubtful, as it is very difficult to draw the line between them. One class is caused by an over eating of green food, such as clover or green corn fodder, and are sudden in their attacks, the animal often being dead before its illness is discovered. The second class is much slower in its advances, and is due to over feeding upon grain or other rich food. In either case it will be found that the walls of the rumen have lost their contractibility and do not move the fermenting mass around. One of the primary steps in treatment is to endeavor to restore, and even increase, the contractile power of the organ; for this purpose doses of ginger administered in warm water are beneficial. If there is no inflammation, as in recent cases, motion is beneficial, and if kept moving rapidly the animal will often relieve itself of the accumulating gases by belching. In any case, a straw band placed in the mouth and tied up over the horns will assist the rumen in relieving itself from the accumulating gas. If the attack has progressed to the inflammatory stage, the quieter the animal is kept the better, for any motion of so large an organ as the rumen will but increase the irritation and do injury.

In bad attacks, after the rumen has been emptied, the attendant inflammation may be modified and reduced by doses of opium and bicarbonate of soda, in doses of from two to five drachms (half of each), given in a small amount of milk-warm water.

In enumerating the causes which may produce this trouble, Professor Simonds writes: "We may have alvitis from dessurrection or depraved appetite, which essentially happens when the animal is pregnant, such as eating linen, pieces of wood, bones, &c., and it is a common occurrence for a cow to eat the placental membranes after calving."

In dangerous cases of hoven, it is advisable to give immediate relief, and in such cases an opening may be made into the rumen. In the absence of a better implement, the smaller blade of a pocket knife may be used, although a round and sharp-pointed instrument is best. The opening should be made at the point (well known to all who have dressed a beef) where the rumen or paunch is attached to the flank. This point is on the left side and varies from five to nine inches in di-

ameter. An opening made at the point of junction carries very little danger with it, because, the two muscular coats, being securely joined together, the contents of the rumen cannot escape into the abdominal cavity, and thus produce inflammation and injury. The proper point for the insertion of the blade is about one span from the point of the hip bone, front and downward. If the blade of a pocket knife is used, it should remain in the incision until a goose quill can be introduced to keep the cut open. The reader will find a very convenient instrument for this purpose illustrated and described on page 141 of Professor Law's Veterinary Adviser.

In cases where relief must be at once afforded, and before a veterinarian can be called in, Dr. Law recommends doses of soap suds, lime water, weak solutions of soda, and if fact of any anti-acid substance. care being taken that the solution is not sufficiently strong to injure the tissues of the throat and stomach.

Medicines.

The following medicines are often used as remedies for the disease which we have enumerated, and we add a list showing the amounts, effect and manner of administering each, as given by Dr. Law in his "Farmers' Veterinary Adviser," which should be in the hands of every stock raiser and owner:

Barbadoes aloes.—Dose from two to four drachms, according to size and vigor; to be given in a ball.

Aromatic ammonia.—Given as stimulant. Dose from two to four drachms, according to size; to be given in warm water.

Carbonate of ammonia.—A stimulant and diuretic. Dose four to six drachms, according to size; given in warm water or ale.

Calomel.—Dose one to two drachms. Acts as a purgative; given in powder or diluted ball.

Castor oil.—Purgative. Dose from one to one and one-half pints; given with warm water or in its pure state.

Croton seeds—Purgative. Dose fifteen to twenty.

Croton oil.—Purgative. From twenty to thirty drops; given diluted in any convenient way.

Dovers powders.—Sedative. Dose three to four drachms.

Ginger.—A stimulant. Dose from two to two and one-half ounces in warm water, milk or ale.

Glauber salts.—Purgative. One to two pounds; given in warm water or other liquid by drenching.

Lime water.—Anti-acid. Dose four to eight ounces in water.

Linseed oil.—Laxative and slightly purgative. Dose one to two quarts in water. In the latter amount a slight purgative.

Epsom salts.—Laxative. Dose from one to two pounds in water or milk and water.

Olive oil—Laxative. Dose two to three pints.

Opium.—Dose two to four drachms in warm water or in a ball.

Black pepper.—Stimulant. Dose two to three drachms in liquid.

Quinine.—Tonic. Dose twenty to thirty grains.

Bi-carbonate of soda.—Anti-acid. Dose four to eight drachms.

Common salt.—Dose two to four ounces in water.

Turpentine oil.—Stimulant. Dose three-quarters to one ounce.

Carbonate of zinc.—Tonic and astringent. Dose two to four drachms.

MISCELLANEOUS PAPERS.

[Read at Annual and Special Meetings.]

UNDERGROUND CURRENTS, THEIR SOURCES AND SURFACE INDICATIONS AS THEY RELATE TO THE QUESTION OF DOMESTIC WATER SUPPLY.

By Dr. J. P. EDGE, *member-at-large.*

To the housekeeper the question of an unfailing supply of pure water for household use lies at the bottom of success and comfort. Without it neither health or true living can be assured, and the convenience with which it is obtained contributes largely to the measure of that true living, not less than the sanitation of families. For in these latter times, when we hear so much about septic germs, and systemic or blood poisonings from impure water, this question of pure water rises to the top.

It is so well proven now that the wells, springs, fountains or cisterns, from which the masses of people obtain their family supplies, may, by mere accident, or from carelessness or neglect, become highly poisonous, and be the means of spreading contagion far and wide, that some authority should be vested, providing for the inspection of all localities where zimodic diseases make their appearance, and a careful analysis made of the waters used by those affected. The State Board of Health are supposed to fill this requirement, but they do not, both for want of authority and the means to carry on the work.

At an early period their authority should be extended and the money placed at their command, to enable the commission to do more efficient service.

This Board has a standing committee on "water supply to farm buildings and farm stock, and on irrigation." Some valuable matter has been furnished by the chairman, Mr. Searle, on drainage and irrigation, as may be found in reading our reports. The committee, unlike all others of the standing committees, has its own time and way to report, and so far has made none. The subject in hand belongs properly to the work of that committee, and what is here given may as well be considered as a committee report, a minority one if the majority dissent.

The flowing spring is, at all times, the best means for water supply. Welling up freely from the rock, it is not charged with microbes or other forms of microscopic mischief makers. Fortunately for our people, Pennsylvania is well supplied with flowing springs.

Here is the little map that is placed as the frontispiece to all the numbers of Professor Lesley's "Reports on Geological Survey." It shows how the great rivers of the State are fed by myriads of little rivulets that have their source in the countless spring heads of the mountains, hills and valleys. Possibly no other State of the Union is so well supplied. The perfection of its drainage is simply wonder-

ful, and is, as we see it on the map, as complete as the great system of veins that drain our corporeal bodies, reaching and ramifying into every nook and corner thereof.

The flowing spring is the outlet for some reservoir or storage basin deep in the body of the ground. They may be of limited capacity or extent under vast areas, and in amount be inexhaustable. Let me remind you of the flowing rivers that have been explored in the great caverns, as the Styx in the Kentucky cave, and others not less wonderful, as examples of these underground currents. Again, in the sinking of artesian wells, and in boring for petroleum, what great reservoirs have been tapped, from which water is forced by the pressure behind to a great height! As another illustration, I may refer to the great basins that underlie the city of Paris. Here, in sinking their wells, some four or five successive reservoirs are penetrated. A case is stated as occurring at St. Ouen, near Paris, where five were penetrated before pure water was secured, at a great depth, and from this water was thrown, by the hydraulic pressure, to the height of fifty feet. The beautiful flowing spring at Bellefonte, and others like it, show also the great volumes of this storage provision designed for the use of God's creatures. But of these deep currents and storage basins there are no surface indications, except in a general way, as at Paris, already referred to. The greater part of the area of the State of New Jersey and the Delaware alluvium is one vast underground basin from the nature of its geological position. It is a continuous gravel bed overlying a great clay bed, the one being the absorber and carrier of the cloud waters, and the other the retainer or water-bearing stratum. This is probably the key to the explanation of the whole subject of underground supply, whether the surface be alluvium, great sand areas or rock.

The progress of geology has given us a pretty complete comprehension of the whole series of rock formations, the belts of country where they come to the surface, and the areas which they occupy still underground. We know also, very fairly, the water-holding and the water-passing qualities of each one of these many rock formations. We know which of them are cracked or cleft by cleavage planes, in comparison with one another, and also their solubility; that is the ease with which the waters which pass through them dissolve and carry away the walls of the fissures, in this manner enlarging them into caverns of every possible shape and dimension, both vertical and horizontal, chimneys and tunnels. We are perfectly sure also that, in the vast majority of cases, the finding of a practical abundance of water at the bottom of a well, or a bore-hole of any kind, depends upon its reaching a water-bearing stratum, and that such water-bearing stratum almost always, if not always, consists of some loose rock, porous gravel bed, or quicksand bed, lying upon some impermeable or tight stratum, usually clay. This rule holds so good, and is so universal, that science can afford no better guide to the seekers after water in any region. It is only necessary to include the cavernous limestone strata, with the gravels and quicksands, to make the rule complete. For, as a gravel bed lying upon a clay bed must necessarily catch, hold and distribute the rain water which has penetrated the overlying rocks and descended to it, thus making it water-bearing stratum, so a great limestone formation, cracked, dissolved and honey-combed with vertical passages and horizontal caverns overlying a great formation of clay shales, plays the same part in nature, only on a grander scale, inasmuch as

such limestone formation cannot hold the water which comes to it, nor can the clay formation underneath allow the water to pass down further; therefore it must always happen that the bottom plane of any limestone formation, lying not upon sand but upon clay, must necessarily be a water-bearing stratum. The only difference between a limestone formation and a loose conglomerate or porous sandstone formation consists in this, viz: That the limestone formation, if large, will probably have clay streaks in it, each one of which will shed the water for itself over any area which it may occupy, without any regard to the next lower sub-division of limestone, however cavernous that may be, whereas gravel beds or quicksands are charged with water from top to bottom alike, and their water-bearing stratum must necessarily be at the bottom.

The rain water which is continually falling upon the surface of the country charges the underlying rocks with as much water as they will hold or take with sufficient rapidity, and then the rest of the rain water, especially in heavy rainfalls, runs over the surface into the sea. The rate at which the different formations can take the rainfall from the surface will determine, in a great measure, how completely charged with water they will be; and will also determine the number and strength of the springs which issue at their outcrops. Water will permeate all rocks, but with very different facility, being soaked up by the sandstones more rapidly, and by the clays very slowly; but the sands and the clays alike become filled with water to varying depths beneath the surface. But it depends far more on the number of cracks in the rocks than upon the coarseness or fineness of their grain how much water they will take, hold, and pass down to the springs. The newer formations, like those of southern New Jersey, imbibe the rain water chiefly through their pores, that is, the spaces between their grains, and in this way become completely charged, like a continuous sponge; the water descending to some water-bearing clay.

The older formations, on the contrary, where they lie as the newer New Jersey sands, differ from them entirely, in being traversed by millions of vertical fissures, usually in two directions. They have been dried and cracked; the cracks over the whole district maintaining about the same general direction; and such a system of cracks is supposed, with the best of reasons, to have been produced and increased from time to time through geological ages by innumerable earthquakes. Now it is in such systems of cleavage fissures that a very large percentage of the annual rainfall of a country is permanently held, and it is easy to see that the water supply of the inhabitants of a given district will depend in a great measure, not only upon alternations of sandstone and shale strata, but on alternations of strata crowded with these vertical fissures and others which have not yielded thus to earthquake action.

As of the other branch of the subject, that of surface indications, there is absolutely no rules to guide us with certainty beyond the general appearances of the topography and the geology of the given region. Authorities on the subject are not to be had to any extent, and the knowledge can be sought or found, only, in a multitude of undigested facts and statements of observations confined to special localities. Every case must be studied by itself therefore, and its special features duly weighed. Within the range of the great water basins where bore-holes have developed the water-bearing strata, not much difficulty will be had in finding the outcrops, or drainage points.

This will apply in the most general terms to those regions like southern and middle New Jersey, and western Pennsylvania and New York, where the strata are practically lying in a horizontal position, as they were at first formed, one over the other. But in middle Pennsylvania and more especially in the south-eastern section of the State, where the rock formations have been contorted and upthrown into almost every shape, and broken up in so thorough a manner and in every direction, producing cracks and breaks without limit, it is nonsense to speak of any large continuous areas of water-bearing strata. Almost alone in the limestone formations, in these sections can any thing like continuous areas of this kind be found, and this because the limestone preserves to a degree its cavernous character and is intersected by great deposits of water-bearing clays.

But in all these regions there *are* certain surface signs that afford intelligent guidance to the water seeker, and it is to these that the philosophers of the "divining rod" are indebted, largely, for the success that so often attends their mysterious wanderings; a success that is large enough to secure the unwavering faith of many would-be enlightened people.

In an undulating region, the man who has his home well up on the ridge must, as a general thing, seek his water supply from an altogether different basin than the man who lives in the valley and who must find a basin at a lower level; unless the former, failing to find all higher, extends his bore-hole to the level of the lower basin; or the latter seeks a supply from the basin above him, and from which he can secure a flowing stream, at his door.

On either side of the water sheds of all ranges, and on the sides of most isolated hills of large area, may be seen fissures or depressions in the surface, shallow near the summit, and usually enlarging as they descend; surfaces that collect and carry the surface water in time of rain. Now under these, at uncertain depth, may always be found water channels that connect with the reservoirs in the hills. When in wet times these depressions are examined, spaces will be found where the ground is yielding often to the extent of forming extensive quicksands. Here, with proper selection of the place to bore or dig, water in free supply is almost a certainty. Along these depressions, also, may be seen during dry seasons, areas showing the growth of swamp grasses, Paspalum in more or less abundance. This is an almost unfailing sign of water near the surface, and it is a peculiarity of these outlet currents, that they sometimes run for a long distance near the surface where they can be traced, and finally appear as a flowing spring, while the supply basin may be many miles distant.*

Now it may often be found to be an easy thing to develop these outcrops, by shafting or tunneling, and by easy grades convey the water to desired points for domestic use. And this advantage may be extended to the remoter side of the watershed when necessary, from which, by the aid of a syphon, or improved mechanical appliances, such as are now brought to the verge of perfection, the stream can be utilized as desired. Beyond the above suggestions, I know of no certain guide to the location of water under ground.

The subject is as obscure and difficult as it is important, and in the absence of any established authority on the subject, it is to be hoped that Professor Lesley, the learned and untiring head of the Geological

* The same conditions may be seen to a limited extent in the valleys, and always indicate the nearness to a water-bearing bottom, where supplies may be found.

Survey of our State, will, as a part of the (legitimate) inquiry under his direction, make a special report on this subject. In this connection I must express my acknowledgments to him for some of the suggestions contained in this paper.

In these latter times, when househelp has become almost a thing of the past, it is due to the tired out remnant of female help, that every available means should be utilized to do away with the wearisome pump handle exercise. There is a very deeply interesting question that bears a close relation to our subject, but it is too large in its scope to be included in this paper. What has become of all the rain water of all the ages, that has soaked into our mother earth. To answer this question would be to open up the whole subject of the chemistry of the rocks and soils, the vast beds of coal and oil and gas that lie deep in its depths, and of organic chemistry as applied to vegetation. In that study we will find that a large per cent. of the rain water is now a fixed part of many of these formations, as in the hydrans rocks; that of other large per cent., the oxygen and hydrogen have dissolved partnership and each sought new affinities, forming new compounds; and that, even in these later changes, another large amount of water has been absorbed as a part of the new formation and has taken on the solid form. Thus in our limestones and gypsums we find a large per cent. of water, that may be displaced by heat and again restored and absorbed into the solid form. Over one-eighth of the weight of our brown hematites, for instance, is water, in a solidified state.

Professor Lesley says that "a large amount of this water is used up in the formation of petroleum and gas; not merely in the so-called oil and gas regions of the world, but every where over all the continental regions of the globe; for rock oil and rock gas are absolutely universal to all rocks, the oldest and the youngest. Any water therefore that is present in the ground may be considered as the overplus beyond what the chemistry of the world wants, and is found flowing through or stored away in the cracks and caverns, from level to level, until it reaches outlets in the form of springs. Without these great storage reservoirs and flowing springs, what kind of a world would this present? Doubtless one less cheering even than the cold and silent moon.

"Traverse the desert, and you then can tell
What treasures exist in the cold deep well;
Sink in despair on the red parched earth,
And then ye may reckon what water is worth."

WE DERIVE EFFICIENCY BY DOING.

By Mrs. MARY V. BOWMAN, *Nanticoke, Luzerne county, Pa.*

The whole civilized world is advancing, intellectually, with grand strides, and in this land especially the agriculturists are lighting their institutes and granges with the torches of progress and are shining brighter every year. There is no glitter of show but for better. There is thought and a full sense of the gravity of the problems of the age. Public-spirited men and women north, south, east and west clasp hands in a spirit of concord and mutual effort. Out of farmers' institutes, conventions and granges have come development and discipline.

Look how the country folk speak out with a voice that is heard in the Senate and the halls of legislation! Witness the inter-State commerce bill! Unlike the provinces of France, where they exert no influence, in answer to the question, "What do the provinces think?" "To ask what the provinces think," said a celebrated Frenchman, "is like asking what a man's legs think," will no longer apply to the rural voters of the States of the American Union.

Now, we know the characteristics of a good American citizen are independence, self-control and a high sense of individual responsibility. These qualtiies are self-developed under the influence of free schools and institutions instructive with the spirit of liberty. Foreign institutions produce a dependent condition in their people. America teaches them a high sense of individual responsibility. Our people should believe that patriotism is a branch of culture as essential as arithmetic. Our youth should be taught patriotism, and their school studies should as far as possible be connected with the actual world around them—the present. It will incite in them a greater zest for study; form a taste for solid reading. They will learn to appreciate the present, and not only be a "looker-on in Vienna," and out of it will grow a desire to be doing their part well in the present. This, as well as all prospects calculated to advance civilization, requires great, self-sacrificing labor, and often it is the few men and women who do the work; minds bright at other times suddenly appear dull when there's work to do.

Who does not know men and women who never can be buried; their bodies may be covered out of sight, but they still live. You look down in the cemetery and read the inscription on the tombstone, but you say, "he is not dead;" "she is not dead." Why? Because when upon earth they were doing. They have left a bright ray of Christian influence that permeates their many works of benevolence.

A clergyman went into a business man's office and saw on his shelf a number of scientific works, and asked, "Do you read those books?" "Oh, yes," he replied, "they make up a great deal of my life; I sell coal, but I don't live on coal." Upon hearing this I thought if the women of busy home cares would get out into some of the benevolent works of the day it would add so much to their lives and help them in their home work. I am the last one to advocate the neglect of home duties; those who know me are aware that I am not one to slight the household. We do not live on bread alone, and I believe those who take part in advancing the worthy projects of the present will be all the better able to attend to their home duties. They will feel brighter and inspired by taking a part in the outer world; mine may be an insignificant part, yet I must perform it. We must shine, you in your corner and I in mine. It is not vain to assert that the temperance cause is woman's work; there are yet Deborahs and Esthers who must stand between the threatening of the people.

In looking at a river I sometimes think it flows upstream. It looks stagnant; and in order to convince myself that it is not, I want to throw something in it; but we know it flows on to the sea, for there is an under current, and on it flows until it becomes purified.

We are drops in the current which flows on, and some day—we may not live to see it, but the children will—the fruits of our well-doing.

It is a blessing to have a chance in this world. Grant was an egg laid in a nest until the war hatched him up. No training can give us the faculties not bestowed; but culture improves those not specially

gifted, and a love for some special work or pursuit can be cultivated, and "we derive efficiency by doing." Would we be educated? Then we must not resort to expedients to avoid its hardships. A thoroughly interested student may gain from books and photographs greater appreciation and knowledge of foreign countries than thousands who travel through those countries and often only bring from them a number of Frenchisms. A foreign minister's wife met at a reception in Washington an American young lady, who continually introduced French words in her conversation. The former spoke to her in broken English, and gave her a just rebuke by saying, "I'm surprised you do not speak wholly your own language. While in this great American country I speak—although poorly—the same language as Americans, and consider it an honor." Humboldt is said to have boasted that he had not used a word that was not pure German for thirty years. Of course it is a gain to us if we can imitate a French word in our own language; but let us keep our language pure. We should learn all the languages we can. It is said the ability to speak five languages gives one a sixth sense.

The school is open everywhere, to all, regardless of condition or race. And the church ever invites the wayward to her altars, and education is accepted as the shield of patriotism. Religion, conscience, conviction on all private and public issues are guarded as the jewels of our freedom. In Gladstone's eloquent reply to the invitation from the Centennial Commission, he gives his opinion of the Constitution of the United States in these words:

"I have always regarded that Constitution as the most remarkable work known to me in modern times to have been produced by the human intellect, at a single stroke (so to speak), in its application to political affairs."

He also wrote of the "high duties and responsibilities proportioned to our ever-growing power." It pleased me to read on September 15 last, of an original and enterprising vender, who stood on Chestnut street, above Eighth, Philadelphia, attracting many buyers by his shouts of "Here ye are, now! The official programme complete and the whole Constitution, all for ten cents. How many of yez knows what de Constitution is, anyhow? Not one in a hunnred of yez. Only a dime. Here ye are!"

Now, if there are any parents within hearing who have sons and daughters who have not read the Constitution, let them resolve at once to have them read it before they become a week older. Also, have them learn that Gladstone is called "That grand old man," because for half a century he has been identified with English history, advocated liberty and humanity, and that he is the grandest statesman of the day, because he has been *doing*. And to keep themselves informed of what he is now doing, how far reaching his advocacy of the Irish question, that the growth of democracy in England is behind it, and more important than that question itself.

There is a great law stamped upon us. We must either improve or retrograde. Those who are content with their present acquirements are in sympathy with James Russell Lowell's latest aspiration:

"O days endeared to every muse
When nobody had any views;
O happy days when man received
From sire to son what all believed."

In these days, however, if a man has capacity he must be the enemy of all narrow mindedness in religion and in politics, or else he must put his conscience to sleep (if that be possible); how else annihilate everything like progressive principle? Life is a conflict; it is a blessing in the struggle to have a good physique; all through life there is to be overcome the power of resistance. Those who are weak may find comfort in the acorn becoming a strong oak despite the terrible storms of nature. There is a great deal in the doctrine of the survival of the fittest. This we learn by the study of nature, and the grand study of geology is a silent testimony.

Let me here draw a picture of an ideal family; and how delightful it is to call upon a family where you see at a glance that everything indicates refinement, scholarship, artistic culture and the evidences of success. You find every member of such a family courteous in manner, with time to receive any person who has a part in the world's advancement, although they may lead busy lives. They have method in the labor, and make for themselves the highest standard. They educate and elevate while they entertain. They may be in a position of influence, but they do not forget that they made their own success by energy, will power, and by being cautious and prudent, aiming at nothing less than perfection, which is only attained by *doing*. It was Washington's experience in the wars with the French, the British and the Indians on the western wilds, and his military life that fitted him to lead in the Revolution. A friend of Alexander the Great, while visiting him, asked: "Why are these men, women and children in camp?" "Look what they are doing," said Alexander, "shooting with bow and arrow, throwing javelins; these are my future soldiers; they are playing war, but they will become so efficient that they cannot be withstood."

In conclusion, I will refer to the sad fact of the limited supply of efficient help in the household, on the farm, in the town and city. Women suffer most from inefficient help, and profit most from good help. The starting and conducting of a kitchen college ought to be woman's work. It should be a school having a curriculum of everything relating to practical housekeeping, with scholarships and diplomas, with lectures, and clear, simple text-books, and fees that will come within the means of women and girls who must work for their daily bread. Its degrees, certificates and prizes must be worked for and won by *doing* on the part of the student, who then receives her prize as a perfect right.

Since writing the above I learn that "Mrs. Whitney, wife of the Secretary of the Navy, has a school for the establishment of a college (for the training of domestic servants) to be located in New York city." To make it a success it must be a national institution. Miss Goodale has been in the West teaching Indian girls how to sew, cook and bake. And no friend of education can fail to be gratified at this; but it is also understood that the supply for practical housekeepers in the East, in fact in every State in the Union, is sadly deficient. Are mothers at fault? It seems so. Are they not inclined to think that anything in the line of housekeeping is degrading, and have not taken the pains to teach their daughters? If they do not know how this work should be done they will be imposed upon by incompetent help, and illy prepared to cope with adversity school should it overtake them.

Domestic economy is a science, a theory of life. The royal families

of the old countries have their children taught some useful trade or other, and oblige them to have a practical experience of it.

Again, action and thought are both needed in the world. Lowell spans a continent with winged thought. J. Gould spans a continent with railways. Which is king? Is it the man of thought, or the man of action? Keats said "Fine thinking is *next to fine doing*; the top thing is the universe." Fishes in the Mammoth cave of Kentucky have no eyes. They once had eyes, but, by non-using, they have lost them. Let us not forget the admonition of our Lord to the servant who hid his one talent in a napkin.

HOW TO BUILD AND MAINTAIN PUBLIC ROADS.

By Hon. WILLIAM GATES, *member from Venango county.*

[Read at Bellefonte meeting.]

Perhaps there is no subject that has agitated the attention of the traveling public so much as our public roads. It has been the highest ambition of the members of the Legislature from the rural districts to improve our public roads by statute. This desire may have arisen from obstructions in the way to reach the coveted voter, but road laws and wind will not make roads. When this State was first settled the inhabitants were scattered and poor, with nothing to sell and but little to exchange for salt and coffee, or tea, on Sunday morning. Everything that was transported was on horses' backs "with the grist of grain in one end of the sack and a stone in the other end to balance." The road or pathway was located up the mountain without any regard to grade to keep out of the timber and mud. As the population increased and better facilities required for travel and transportation many changes have been made to improve the grade and serve the convenience of the people. Under the old supervisor law there is no system. The supervisors are elected annually. They levy a tax on the assessed valuation of property and notify the taxpayer to bring a certain implement and work his tax. The supervisors may have no skill to open a new road or repair an old road, and with thirty or forty men and boys (mostly boys) will pass over four or five miles of road in one day, making no permanent improvement. And so long as the land owner and heaviest taxpayer permits his money to be wasted in this way our public roads will not be constructed and maintained as they should be. There is no expenditure, if properly and substantially made, that will add more to the value of real estate than good roads, and yet how few take any interest except to get their taxes credited on the tax book. All seem to realize it as a fact that public roads are for the public and not for themselves, but when they take a drive and find that the road does not suit their taste they find fault with the road and the road officials when they should find fault with themselves. But let us get to business. On all roads not laid out on the easiest grade obtainable abandon the old road before any more money is wasted on it and relocate on the easiest grade that can be obtained, keeping the fact that it is no farther around the base of a mountain than over the top. Swamp or wet land is no obstacle in the way, as all roads must be constructed in the same way, whether the ground be wet or dry, and the nearer level they are the less damage

they will sustain from the most destructive element they have, and that is water. On all roads on side hill cuts the road should be from twelve to sixteen feet wide from the ditch. Good stone culverts should be built at all points where the water collects to let the water escape. Stone bridges should be built over all the small streams and come so near the level of the road that a small quantity of earth will make it level. On soft ground a track of some hard material should be made in the center from one to two feet deep and eight feet wide. Slag or limestone is best, but, if obtainable, sandstone will answer a good purpose. Then cut the side ditches round the road so that the surface water will flow off the road. On rising ground the road should be turnpiked and from sixteen to eighteen feet from ditch to ditch, and to prevent damage from surface water, brakers should be placed as often as required in the shape of the letter V, the highest in the center, and slope gently to the ditches, so that vehicles passing over it will be but little obstructed in the passage, or by cutting a depression so that the water will flow to the ditches. Roads that are well turn-turnpiked will shed the surface water until worn by the tracks of vehicles, but to guard against damage by heavy rains drainage should be provided for protection. As soon as our roads are properly graded and culverts and bridges substantially built, all stumps and rocks removed, procure and have the roads kept in repair with one of the best road scrapers and the cost of keeping in repair will not be one-fourth of the cost now nominally spent, and better roads will be the result. The introduction of the road scraper in some of the townships of this State has been objected to on the ground that their use would result in the abandonment of the privilege to work out the tax. But to offset that objection experience has proven that by their use the taxes can be reduced more than one-half and the roads greatly improved. Machinery has revolutionized and cheapened everything. The road scraper has come to stay. I am not the manufacturer or agent of any scraper, but of all that I have seen the New Model Reversible Champion is the best and easiest handled. It is time that a new departure was taken in making and maintaining our public roads. Our road laws are too loose. The taxpayers' money has been wasted for the want of engineering skill and the power to control the labor employed. There was a bill passed by the Senate at the last session that has some good features and in other respects is very defective. I think it could be amended so as to make a good law. My object in selecting this subject was for criticism and discussion, and I think I have said enough to accomplish that purpose.

THE FLORA OF CRAWFORD COUNTY.

By Miss JENNIE E. WHITESIDES, *Harmonsburg, Pa.*

[Read at Conneautville meeting.]

By the flora of Crawford county, we mean its vast wealth of vegetable growth—the bright-eyed blossoms which appear here and there in the greatest profusion. Wander where we may, through the wood, along the roadside, the valley, the meadow, everywhere, we find many representatives of the floral kingdom.

We admire their coloring, their symmetry of form, their diversified leaves, and with all, their perseverance. How they will struggle along to overcome difficulties, climb over hedges, creep around intervening objects, until the situation is won, and they stand forth bright examples of an accomplished end.

It would not be entertaining to give the regular classification of plants as they occur. We can merely glance here and there over our flora, every part of which abounds in a rich and varied vegetation, ranging through every grade from the insignificant lichen to the largest forest tree. Many of our native plants are widely distributed, having the happy faculty of being quite at home in any situation, while others are restricted to narrow limits. The sandy shore of the lake has its own vegetation. The margin of the bay differs from the interior, the hill from the low land, each situation giving its own wealth of growth. frequently a vast medley that few but the student of nature care to investigate.

With the first of May the spring flowers appear. In the wood, the sweet-scented purple phlox and lovely white trilliams; along the hedge, the bellwort, with its delicate bell-shaped blossoms nodding above the violets and anemones; in the swamps, the golden blossoms of the *coltha palustris*, resting on clusters of glossy green leaves; in the low ground, the Dentarias and spotted-leaved adder tongue, followed as the season advances with a succession of beautiful bloom.

Some of the early flowers blossom and ripen seed before the leaves on the trees have unfolded. Delicate and short-lived as they are, each one has its own peculiar individuality.

The little liverwort (*hepatica triloba*) lifts its delicate blossoms upward when the sun shines directly upon them, closing at night and remaining closed, should the day prove cloudy, while near by the delicate spring beauties, while they close at night open out brightly in the morning whether the sun shines or not. Later in the season the evening primrose opens its bright yellow petals just as the sun's rays sink behind the western horizon, and closes them at their first approach in the morning. These early blossoms are less complicated than those which appear later. As the blossom is the crowning point of the plant it first attracts attention, and to be really beautiful must harmonize in color and arrangement of its different parts.

Scattered throughout the flora are many small trees and shrubs whose beauty are worthy of notice. The juneberry (*amalanchier Canadensis*) is a small tree, producing in April an abundance of pure white flowers, looking in the distant wood as if a lingering snow storm had showered its contents upon this tree alone.

Another small tree which blossoms in May, brightening up our hillside forests, is the flowering dogwood (*cornus Florida*), its blossoming is peculiar. The small flowers are aggregated into a flat head surrounded by an involucum of four leaves an inch or more in length, these gradually become pure white. As these blossoms appear before the leaves they are very ornamental. In damp ground, blossoming in June, is the *vibusnum opulus*, a much branched shrub, eight to twelve feet in height, with three-lobed leaves and numerous cyrnes of small flowers, which are bordered with yellowish white neutral blossoms; the first ripens in September, is of the color, size and somewhat the flavor of the cranberry, given the common name of "high-bush-cranberry." The lovely "snow ball" of our gardens has been cultivated from this shrub. A near relative of this is the common

elderberry, *sambucus Canadensis*, which seldom fails to yield an abundant crop of edible berries. Early in May its sister-plant, *Sambucus pubens*, comes into bloom; it is not at all attractive then, but the last of June, when covered with thyme-like clusters of bright crimson berries and glossy green foliage, it fully atones for all early deficiencies.

But our flora is not made up of plants alone noticeable for their beauty. On the upland hills and in the swamps grow several species of the "huckleberry" and "blueberry." In the marsh, with its roots nestling in among the Sphagnum moss, and its delicate prostrate stems scarcely visible, is the home of the cranberry.

In the thicket, the sweet-scented crab apple each year yields its abundance of never failing fruit. Along the hillside, the *prunus Pennsylvanica* (wild red cherry) blossoms and ripens fruit very much like the common cherry, only smaller and more acid. In the recent clearing is the seldom failing supply of raspberries. Occasionally, such a freak of nature as a bush bearing white blackberries, is found. In the Pymatuning swamp grows the *myrica cerifera* (wax myrtle), a small shrub with fragrant leaves and abundant clusters, close to the stalk of small round nutlets. These are covered with a waxy substance, which, when removed and cleansed, is a vegetable wax. Candles made from this "are said" to burn readily, and emit a peculiar balsamic fragrance. A lady living near the swamp gathered one season enough berries to yield seven pounds of this wax.

Our poisonous plants are scattered through several orders. The poison dogwood (*rhus venenàta*), common in bogs and swamps, is a large shrub, with pinnate leaves of from seven to thirteen leaflets, which color magnificently in autumn; passing from green through a bright yellow to scarlet. This plant seems to possess a general propensity for evil, from its constantly throwing off a poisonous effluvia, by which many persons are affected with painful swellings and inflammation from just passing near where it grows. In July, when in blossom, it is not any more troublesome than any other time.

The *rhus toxicodendron* (poison-ivy) possesses the same quality, though less decided. This plant frequently climbs over fences and hedges near dwellings, and in the wood envelopes large trees. The leaves, which are ternate, that is, three on one stem, color brightly in autumn. Along the vine at short intervals are clusters of rootlets, with which the plant adheres to, whatever it climbs. These two plants belong to the "sumach family." The last should not be confounded with the common "*ampelapsis quinquifolia* (Virginia creeper), which has fine leaflets, and climbs by means of little tendrils, that expand into clan-like disks. This is the most beautiful native vine in the flora.

The *umbelliferæ* (parsley family) is a most suspicious order, as to it belong edible plants for which the poisonous ones are liable to be mistaken.

The water hemlock (*cicuta macualta*) is entirely too common about ponds and low grounds. It is said "that a drachm of the fresh root has killed a child in an hour and a half." This is a tall, rank herb with a smooth stem, streaked with purple, has white flowers arranged in umbells and large compound leaves. There are two species, both equally dangerous, in the *ranunculus* family (the yellow buttercup), a common plant of pastures and fields, when taken internally produces dangerous symptoms. This accident does not happen very often, as

its blistering tendencies cause it to be rejected. Drying removes the noxious qualities. It is then eaten by cattle.

The lily family contains the white hellebore (*veratrum viride*), the root of which is a deadly poison. This is familiarly known as "Indian poke;" grows in damp ground; has, in July, a tali spike of greenish-white flowers. There are many other plants which contain poisonous qualities. Some plants exhibit very peculiar characteristics. In the Pymatuning swamp, on the west border of the county, is found the *sarracénia purpusen* (pitcher plant). The leaves are hollow and pitcher-shaped, usually half filled with water and drowned insects. The inner surface of the upper portion of the leaf is clothed with stiff bristles, so that, when an insect once gets in, there is no escape. Experiments with this plant have proven it to be decidedly carnivorous, absorbing and thriving upon insects thus caught. Indigenous to the marsh is another plant which possesses carnivorous tendencies—the little *sunden drasćra rotundifolia*. When an insect alights on its very small leaves they gradually close over it and remain closed until it is digested. This is one of the plants with which "Darwin" largely experimented.

A prominent parasite of the flora is the common dodder (*cuscuta gronovii*), a yellowish plant that looks like threads of twine vining over and about low-growing herbs and shrubs in damp, sunny places. The seed of this germinates in the ground, attaches itself to the nearest herb, dies at the root, and draws nourishment from the herb about which it entwines, literally stealing its living.

The closed gentian, rarely found, has bright-blue tubular blossoms, which never open out, looking like a bud about to bloom.

On the hillsides near Meadville grows abundantly the "bush honeysuckle" (*azaleu undicalus*). This, when in blossom, is the most beautiful native shrub we have. Indigenous to the same locality is the much-prized "trailing arbutus" (*epigea repens*).

The rocky hills of the eastern part of the county are covered with the low-growing mountain laurel (*kalmia latifolia*). In the Pymatuning swamp we were surprised to find the beautiful rose bay (*rhododendron maximum*) quite a tree, with thick evergreen leaves and large clusters, in July, of pink blossoms, entirely too handsome to be hidden away among the tamarac trees of the swamp.

The *rosaceæ* (rose family) may be placed at the head of the flowering plants, as it is conspicuous for the beauty of some of its members and the usefulness of others, as the apple, pear, quince, and the various small fruits. A beautiful ornament of our flora is the common wild rose, of which we have several species. They need no description, for all who have seen these bushes in the field and along the roadside, covered as they are in June and July with numerous bright-pink blossoms, could not fail to remark their beauty. The swamp form (*rosa Carolina*) is the largest, and continue blossoming until late in the season.

The *compasitæ* contains the largest number of species of any of the orders. Familiar examples of this family are the thistle, sunflower and dandelion. In July blossoms that beautiful nuisance, the (ox eye or white daisy) *lencànthemum vulgàre*. This is an introduced weed. The showy, golden rayed cone-flower of the meadows comes to us from the western prairies. Through September the hillsides and lowlands are ablaze with the different species of the golden rod. The asters, running through every shade of purple to white,

brighten up the fields and roadsides with their daisy-like blossoms, lasting until the severe frosts of November.

In Conneaut lake grow many interesting aquatic plants, among them the *vallisneria spiralis*, a little grass-like plant with delicate blossoms, which rise to the surface to expand. Little bulblets form about the roots of this plant. The wild ducks which congregate at the lake in the fall feed upon these by diving for them.

At the marl pits, growing on the surface of the water, is a floating species of smartweed, *polygonum amphibrium*, a rarely beautiful plant both in leaves and blossoms.

The ferns, sedges and grasses, of which we have many beautiful species, form an important part of our flora.

Among our deciduous trees, the *elm ulmus Americana* is beautiful in outline. The graceful curvature of the branches of this tree distinguishes it from all others. In the New England States this is the favorite shade tree. The maples are always attractive, whether in their early bloom before the leaves appear, or when clothed in the full beauty of their summer verdure. The red maple, *acer rubrum*, is the most beautiful. In April it is covered with brilliant red blossoms, and in August, when the surrounding trees are yet green, it turns a brilliant crimson. The oak is considered as monarch of the forest, a grand represesentative of the power of the vegetable kingdom. The blossoms of the oak appear just after the leaves. The white oak, *quercus alba*, ripens its fruit the first year, while the several species of red and black oaks mature theirs the second year from blossoming. The tulip tree, *liriòdendron tulipìfera*, called both white wood and poplar, is common in open woods—blossoms in June, has large tulip-shaped blossoms of a brilliant greenish yellow, which, among the glossy foliage, make a beautiful display. The cucumber tree (*magnòlià acuminàta*) is not as beautiful in blossom, but when adorned in September with numerous scarlet seed cones it presents an attractive appearance.

The leaves are the lungs of the plants, the great breathing surface, purifying the air for all animal life, by taking up the carbonic acid gas, which is continually forming in the air, by some mysterious process the plant decomposes this; retains the carbon for its solid position, and throws off pure oxygen, which is breathed by all animal life, thus the vegetable kingdom purifies the air for the animal, the animal for the vegetable. The autumn coloring of the leaves at this season is perfect. In no country in the world is this coloring so varied and brilliant, as in our North American forests.

As far as we have been able to learn, one thousand plants have been identified as native to this county; eight hundred and sixty of these have come under my own observation. Our largest blossom is the white water lily (*nymphia tuberòse*), usually six inches across, and containing over one hundred petals. It would be difficult to designate the smallest flower as many of them can only be properly seen through a microscope.

All through the flora, white flowers are the most numerous. In color the shades of yellow predominate; blue and purple come next; red is sparingly represented. In scarlet there are very few blossoms, among them the *labèlia cardinàlis*, whose tall spikes of flaming scarlet are conspicuous in damp soil and swamps, and in the mint F, the equally brightly colored mint (*monàrda dydama*). A few flowers are

brown, some are green, many show intermediate shades, while others are a combination of a variety of colors.

We have spoken of but comparatively few of the plants which make up the flora of our county. There are still handsome orchids, fragrant mints, trailing vines, and low growing plants, speaking to us from every page of this great book of nature, of the wisdom and goodness of the Power, which created and governs them all.

"There is not a tree, a plant, a blossom,
But contains a folio volume;
We may read, and read, and read again,
And still find something new;
Something to interest and instruct,
E'en in the noisome weed."

TENANT FARMING.

By Prof. J. HAMILTON, *State College P. O., Pa.*

"Will we not soon be compelled to abandon tenant farming and invest the money in some other enterprise?" is a question that was asked a few years ago in an after-dinner conversation on farm management and profit.

The gentleman who propounded the question was a man of business and wealth, the owner of a number of fine farms near a city, a graduate of Yale college, a man of unusual intelligence, and one whose philanthropy is widespread, whose interest in his tenants and his farms is in marked contrast with the indifference of most owners of landed estate.

Another gentleman, also eminently successful in business and the owner of many farms in a high state of cultivation, after showing me his own property and having explained his methods and his aims, replied, to a question as to the profits of it all, "that it was an elephant on his hands." These are two instances typical, I think, of a state of feeling and experience that exists all over this country, and the result is that capitalists are gradually and silently withdrawing their money from agricultural pursuits and are investing it in other industries. The impression prevails among owners that a rental farm is an unprofitable farm and that the tendency of the system is to the sure and rapid impoverishment of both the owner and the soil.

It is not necessary for me in an audience such as this, composed of eminent representatives of every phase of farm life and management in this State, to say that this question is important, involving as it does the prosperity of the largest and most necessary and useful industry in this country.

The last census shows that out of a population of 17,393,099 persons engaged in what are commonly known as productive pursuits in the United States, 7,670,493 are engaged in agriculture. The number of farms in 1880 was 4,008,907, and of these there were occupied by tenant farmers 1,024,601 farms, or more than one-fourth of all the farms in this country are rented, and more than one-fourth of all the farmers in this country are tenant farmers. Pennsylvania alone has 45,322 tenant farms, and since a large number of tenant farms must always exist in this country, some belonging to widows and minor children, some to men incapacitated from work, some to men engaged in other

pursuits, and some to individuals owning more than one farm, it becomes, therefore, a very important question to know how this kind of farming may be made profitable for both landlord and tenant.

The conditions under which tenant farming is carried on in this country are about like these: The owner of a farm desiring to rent it negotiates with some one to take possession of it for a term of years and work it in accordance with the customs of the community in which it is located, and take for pay for his labor and implements and time a certain proportion of the produce of the farm and pay over the balance to the owner of the estate. Sometimes the tenant prefers to pay a money rent for the land and bear all the expenses and enjoy all the profits. In any case it is a mutual agreement in which one party furnishes the land and buildings and the other works it.

The success of an enterprise such as this depends, like any other business, largely on who manages it and the conditions that surround it. Instances are numerous in which one man succeeds where another has failed, and even the failure of many is not conclusive evidence that success is impossible.

The class of men who can engage in tenant farming is limited. The farm cannot pay from eighty to one hundred or one hundred and fifty dollars per month in ready money, and the consequence is that active, intelligent men, unless prevented by other causes, leave this pursuit for industries that pay these prices for their work. Another consideration restricts the number. A certain amount of capital is needed in order to stock and equip a farm and to subsist self and family for at least one year. The number of these people in a rural community is small, and is made up mostly of men in middle or past middle life, whose energies are somewhat impaired and are, therefore, incapable of accomplishing the work that a young, active, energetic man could do. Many, too, lack the business training necessary to carry on a farm. They are wasteful, slovenly and careless, and are consequently unlucky. They make no money for themselves or for others. Some are dishonest and deliberately rob the landlord, and some are too ignorant to farm or to have any control of property. These and many other circumstances combine to make the number of really competent, available tenants very few.

Whilst the amount of capital or the incompetence of the tenant may account for many failures to secure profitable returns, they by no means explain them all. There is a great difference in the condition of the farm that the tenant cultivates. Some are in a high state of improvement and fertility and some are extremely poor. Some farms would be dear at no rent and others are cheap at a high price.

Agriculture is the art of obtaining food from the earth, and if the portion of earth that the tenant is called upon to till is destitute of plant food his efforts will be vain. It not unfrequently happens that the surface of the soil is so encumbered with stones or stumps, or weeds or rubbish as to make its profitable cultivation next to impossible. It may be, too, that the fences and buildings are so dilapidated as to fail to protect that which is raised, and thus it is lost; or the land may be wet and boggy or dry and barren. Any one of them, or all of them united, may make it impossible that such land can bring in, even under the most skillful management, a profitable return.

Just how fertile land must be before it can be profitably worked depends upon its location. If it be remote from market or cheapness of transportation it may equal the garden of Eden in fertility, and

yet the landlord can hope for but little return. If, however, it be near a large city, and within easy reach of an abundance of suitable manures, a Jersey marsh or a sand hill in Georgia may be a most valuable and profitable farm. Land may yield one hundred bushels of wheat to the acre, but if it costs seventy-five bushels to get it to market, a farm situated near a city and raising only twenty-five bushels to the acre ought to pay as much rent. And so it occurs that location often counterbalances fertility, and renders profitable otherwise worthless land.

Methods of farming have much to do with the tenant's success, even where the land is good and in favorable location. Some crops are much more expensive to raise than others, and many landlords, not to say tenants, make no estimate of the cost or profit of the several crops they raise, and are likely to continue to raise a large quantity of that which is least profitable, and very little of that which gives the highest per cent. of net gain. Take for instance the most common of the crops grown in Pennsylvania and compare the cost of their production, and we find great difference to exist.

I have estimated * that it costs to raise and prepare for market an acre of wheat about eleven dollars, an acre of corn about fifteen dollars, an acre of grain about two dollars and a half, and an acre of potatoes about eight dollars. Suppose the wheat produced sixteen bushels per acre, the corn seventy bushels of ears, the grain one and one-fourth tons, and the potatoes one hundred and fifty bushels. The wheat, at ninety cents, would be $14 40; the corn, at twenty-five cents, would be $17 50; the hay, at ten dollars, would be $12 50; and the

* *Estimate of the cost of producing one acre of various crops.*

Wheat—Seed, one and one-fourth bushels, at $1 00,	$1 25
Plowing, two-thirds of day, at $3 00,	2 00
Three hundred pounds of fertilizer,	8 00
Harrowing twice and drilling,	1 00
Harvesting and putting into shock,	1 50
Hauling in and mowing,	1 00
Threshing sixteen bushels,	1 00
Hauling to market,	25
Total,	$11 00
Corn—Plowing, one day,	$3 00
Harrowing, three times,	1 00
Rolling and planting,	2 00
Cultivating, four times,	2 00
Fertilizer, three hundred pounds,	3 00
Cutting,	50
Husking, seventy bushels ears,	1 50
Hauling in, shelling and marketing, seventy bushels,	2 00
Total,	$15 00
Hay--Cutting,	$0 50
Curing and hauling in, one and one-fourth tons,	1 00
Hauling to market,	1 00
Total,	$2 50
Potatoes—Plowing, one day,	$3 0
Harrowing, three times,	1 00
Planting,	2 00
Seed, eight bushels,	3 00
Fertilizer,	3 00
Cultivating, four times,	2 00
Raising,	2 00
Marketing,	2 00
Total,	$18 00

potatoes, at thirty cents, would be $45 00. This would give a profit on the cost of producing each of the crops mentioned as follows: 31 per cent. on the wheat, $16\frac{1}{2}$ per cent. on the corn, 400 per cent. on the hay, 150 per cent. on the potatoes. If the land was worth seventy dollars per acre, the wheat would pay an interest on it of $4\frac{6}{7}$ per cent., the corn $3\frac{4}{7}$ per cent., the hay $14\frac{2}{7}$ per cent., and the potatoes $38\frac{4}{7}$ per cent. If these calculations were extended so as to include all of the different crops that farmers raise they would, no doubt, show equally striking variations of profit. How many tenants make these calculations? How many owners make them? And yet the success of their occupations depends upon just such facts.

The limits of this paper forbid more than a hint as to the profits of various methods, but each can for himself in his locality easily ascertain what method he should pursue, keeping in mind that the inequality of profit is not confined to the different crops he cultivates, but exists as well in those that are identical. Thus the kind or variety of stock a man keeps, the variety and quality of the seed he sows, the thoroughness of his tillage all affect the final result.

The tenant has possession of the property, he tills under a lease which defines his rights, privileges and duties, and also prescribes the length of time that he may occupy the land. This lease is a very important instrument, and if carelessly drawn is likely to involve landlord and tenant in more trouble than all the other causes combined. Its stipulations should be fully and clearly defined, and in framing it the principle should be kept in mind, that the interests of the landlord and the tenant ought to be the same, namely, the securing of the largest gain and the improvement of the estate. How can this result be secured? The first requisite is a *good tenant*, a mistake made by him is disastrous, and more mistakes are made right here than in probably any other direction. The idea prevails that any one who can work can farm, and so he can after a fashion, but it does not follow that everyone who can work can make money farming. Successful farming requires not only a knowledge of agricultural operations, but, more than all, good, square, sound, level-headed judgment. These are the qualities that make up successful men in all the occupations of life, and, notwithstanding the popular belief, agriculture is no exception to the rule.

A good tenant then is essential to success, and no good tenant will bind himself by a lease that will not give him a fair chance to make a living for himself and family. He must have a fair share of the profits of the business and the better the prospect for securing a competence the better tenant he is likely to be. The system that exacts the "uttermost farthing" is not only cruel, but tends to dishonesty and dislike, both of which are detrimental to the interests of the owner.

A tenant is expected to secure as large a profit as possible for the landlord. This he cannot do without the expenditure of both money and laber. He is also expected to improve the condition of the estate. This too costs money and labor. No tenant will expend very much money or very much labor on a farm that he expects to leave in a single year. If he is to be expected to improve the property he must have the assurance that he shall have several years in which to reap the benefits of this extra expenditure. This fact is well recognized among business men in the renting of other property, such as houses, factories, mills or mines, and if agriculture is a business operation, there is no reason why it should not be subject to the rules and cus-

toms that have been found judicious and that regulate business in other industries. The landlord then who is wise will see that his tenant is protected from loss by leasing him the property for a term of years.

How long this lease should run depends up the circumstances, but not less than the duration of an ordinary rotation of crops, which is five years, and if possible not less than twice that time, or ten years. In grain growing districts and on lands destitute of natural grass pasture the lease should prohibit the grazing of cattle. Probably more loss results to both landlord and tenant from this source than from all others. Expensive fences must be maintained, land is wasted, fence rows become the nursery of weeds, land is tramped and vegetation is injured and destroyed, the fields are impoverished and their economical cultivation prevented. Let the tenant keep any number of cattle that he chooses if he will cut food for them and follow the soiling process. In order to ensure that some cattle should be kept the lease should require that a certain number of stock should be stall fed during the winter, in order to provide manure for the farm. Where commercial fertilizers are beneficial these should also be applied and in all cases a certain amount of clover should be sown each year. The best form of lease is doubtless one in which the tenant pays a share of the crop and not a money rental, and one in which the gains and losses are equally shared. The stock, implements and equipment to be the property of landlord and tenant as joint owners. Each to furnish half the seed, and half the feed for the stock and each to get half the produce. Each to pay half the taxes, and in all ordinary repairs and fencing the landlord should furnish the material and the tenant board and pay the hands. The tenant furnishes all the labor in the regular farming and landlord furnishes the buildings and the land. The penalty for failure to fulfil the stipulations of the lease should be the immediate termination of the partnership, at the option of the one who is aggrieved.

This is as near an equitable lease as any that I know, and on land of average quality works well and is usually satisfactory to all concerned.

The advantage of this lease to the tenant is that it costs him less to start farming and is less expensive to him after he has started. If there is loss it is divided. If there is gain he has his share. He has a house, a garden, and fruit, eggs, milk, butter and meat, and is sure of a living for himself and family even in the most destitute year. The advantage to the landlord is that his tenant is interested in the proper care of the stock and crops, that the owner still retains partial possession and control of his property and can prevent injudicious practices on the part of his tenant. He can have his farm properly stocked and equipped, and has the opportunity to improve the breeds of his cattle and the fertility of his farm.

But more than all this, he can often secure a suitable and competent man as his tenant, who would have been unable to meet the expense of equipping a farm alone. In this way a better class of tenant farmers would soon be produced, and young men driven now from their country homes be retained.

This brings me to speak of a matter upon which, I am convinced, the success or failure of the whole system of tenant farming depends. I refer to *the size of the farm*. Most farms are entirely too large for renting. I believe that I have never known of a farm of four hundred acres in

this country that was rented that did not gradually lose its fertility, and it is a very rare thing to find a farm of two hundred acres that has ever been improved by tenant farming. The improvement of a farm must be by thorough and seasonable cultivation and by the application of good manure. The amount of capital that is required to thoroughly stock and conduct a farm of two hundred acres is more than average tenants possess, and if a bad year occurs the tenant is unable to meet the expenses that are necessary to produce fertilizers, pay labor and taxes and do the work needed for the successful crop. When a good man is found, who has money enough to conduct such a farm properly as a tenant, he can usually purchase land for himself, and so he becomes an owner and is out of the renter class. So, too, in cases of a failure of crops the renter of a large farm has not only lost his own labor, but that also of two or three hired men, the feed of his teams, the taxes of a large estate, the expense of the fertilizers that he has used and is hopelessly bankrupt.

Suppose on the other hand a tenant with $1,000 or $1,500 dollars to go on a farm of fifty acres, and associate the landlord with him in the equipment of the farm, and suppose a crop has failed. He has had his living and house rent at least. He has his stock and implements and has lost only his own labor instead of that of several hired hands as well. Instead, too, of losing the taxes of two hundred acres, much of which he does not till, he has only the one-eighth of that loss. Instead of losing the fertilizers of such a farm he loses only a trifle, and he has capital with which to begin another year. But the tiller of a small farm is not so liable to losses as the renter of a large one. His tillage is better because done mainly by himself and not by careless hired help. His stock is in better condition with less feed, because of his giving it his personal attention. He has more manure, for greater care is exercised in its manufacture and preservation. His land is clean, because there is less of it to prepare. His machinery lasts longer used by himself. He is more independent, because he can get along without depending upon others for assistance. The landlord is benefited. He has better tillage, increased fertility of his land, better care of his buildings and equipment, more manure, fewer weeds and stones, better tenants, less anxiety and more profit. In addition to this as the fertility of the land increases a greater variety of crops can be grown, small fruits and market gardening may be conducted, or stock raising or dairying may be carried on.

It is objected that this division of property into small farms involves a much greater outlay of capital on the part of the landlord for buildings and equipments. It's true that it will cost somewhat more, and yet the outlay for four fifty-acre farms is not very much greater than is usually expended on one two hundred-acre farm. The buildings may be much smaller and less expensive. Instead of expending three thousand dollars on a house, build houses that will cost about nine hundred dollars. Instead of a two-thousand-dollar, barn build barns to cost about one thousand dollars, and so for the other buildings. The four farms will take about the same stock and not many more implements to do the work. Should the owner ever wish to sell he will have three customers who will offer him his price to one where the farm is larger and unimproved. It is well understood that the principal reason why capitalists do not put their money in farm land is that it is tied up there and it is difficult to get it out of the land again at short notice, and so they prefer stocks and bonds with all

their risks because they can be easily and quickly converted into money if the owner desires. If, however, farm property were divided up into small farms, small enough so that men of ordinary means can farm them and bring them into a state of fertility that will cause them to pay even a low per cent. on the capital invested in them, moneyed men will be glad to secure their surplus capital by investing in this kind of real estate, and so add to the improvement of the entire agricultural interests of the country. There is another feature of the question that makes small farms desirable, if not a necessity, and that is the scarcity and expense of hired help.

The agricultural people are divided into owners, tenants and hired help, and farming has, of late years, to compete for labor with railroads, manufacturing, mining and lumbering industries, and these enterprises can pay higher wages because the work is more carefully directedand there is no loss of time; the labor is under constant and intelligent supervision, and every stroke is accurately directed and every minute is rigidly exacted, and as a consequence the laborer can be paid a high price for a given number of hours of work. In agricultural pursuits it is different, the laborer is largely his own director and can use his time or idle it as he may see fit, and all the loss must come upon the employer; much time too is lost in changing from one kind of work to another and from one part of the farm to another, and yet for this kind of employment the laboring man expects equal wages with the man who is driven from morning till night. These high prices the farmer cannot pay, and so is constantly losing because of work hastily done or too late to be in season for the best advantage to his crops. A farm should be small enough so that a man and a boy can do the work well with the occasional help of an extra hand. This may be one hundred or fifty or ten acres, depending on the location and kind of crops grown.

But you ask what will a small farm pay? I know a farm of one hundred acres, of average fertility, that this last season (and there was a short crop) had an income of $1,500. Suppose a tenant had this on the lease that has been suggested.

His share would have been,		$750 00
His expenses would have been as follows:		
Living, at $20 per month,	$240 00	
Half the taxes,	30 00	
Phosphate,	40 00	
Labor—extra help,	100 00	
Smith bill (one-half),	15 00	
Interest on stock—say $900,	50 00	
Expenses,	25 00	
		500 00
Balance clear profit,		$250 00

At the same rate the tenant would have saved in the course of ten years, $3,295, enough to buy a farm for himself. But how about the landlord? Let us see.

His share would also be,		$750 00
His expenses would be as follows:		
One-half the taxes,	$30 00	
One-half the phosphate,	40 00	
One-half the smith bill,	15 00	
One-half the general expenses,	25 00	
Interest on stock,	50 00	
Interest on 100 acres land (at $70 per acre) at 6 per cent.,	420 00	
		580 00
Profit clear to go to repairs, etc.,		$170 00

Surely this would be no losing operation for either landlord or tenant. I know a man, tenant, who told me, near the close of the season, that he cleared $1,500 year before last off two and a half acres of land.

Legislation can do a great deal for the assistance of tenants without injury to any other class or occupation. Fences might be dispensed with. Roads could be better made if proper legislation were had that would place them under competent supervision and provide better methods for their maintenance. Transportation of merchantable articles could be regulated so as to favor the farmer and do no injury to the carriers. Scientific institutions to investigate and publish reports upon all the questions that agricultural people need to know ought to be liberally sustained. Fertilizers could be guaranteed and the penalty be easily and quickly required. Taxes remitted for a period of years to those who will open out farms now waste and difficult to improve, and special opportunity given to those who will occupy and till them. The answer then that I make to the question of my friend, which I quoted at the opening of this paper, "Must we abandon tenant farming and invest in some other pursuit?" is, change your methods, try a small farm, a unison of interest, a long lease, a liberal share and a young man.

THE CONSTRUCTION AND MAINTENANCE OF PUBLIC ROADS.

By H. W. KRATZ, *member from Montgomery county.*

Perseverance is an important requisite in gaining our objects, and is more closely related to human effort and work than any other element in the pursuits of life.

Were it not that by persevering in any undertaking we hope to win, we would long ago have despaired in the agitation of a subject which has claimed the earnest attention of progressive citizens as well as of legislators. By persisting we build, construct and accomplish whatever is good and valuable. Notwithstanding that the result desired may be in the romote future. Much more has been suggested and devised upon the road question, than has been achieved; and because so little has been done, compared with progress made in other directions, we are inclined to direct our energies and thoughts to objects which contain more activity, progress and profit. But if we expect substantial and satisfactory improvement in public roads we must persist in discussing the subject until the people become informed upon the true methods of constructing and maintaining them.

We are constantly advancing in agricultural, educational and scientific pursuits, and are ready and willing to adopt new and improved methods for their improvement and success.

In constructing a highway for the accommodation and convenience of man, sensible methods should be employed, and suitable materials used. In laying out a public road the course should be as direct and free from curves and angles as circumstances will permit.

Roman roads were remarkable for preserving a straight course from beginning to end, regardless of obstacles which might have been easily avoided. In solidity of construction, they have never been excelled; and many of them still remain, often forming the foundation of a

more modern road, and in some instances constituting the road surface now used.

Two parallel trenches were first cut to make the breadth of the road; loose earth was removed until a solid foundation was reached, and it was replaced with proper material, consolidated by ramming or some other means so as to form a firm foundation for the road.

Four layers of local materials were spread over the road, each succeeding layer being of smaller size. In this way the material was well packed, making a good road, and at the same time providing for good drainage. In England, Macauley says the roads at an earlier day were incredibly bad; and this state of affairs was due chiefly to the state of the law, which compelled each parish to maintain its own road by statute labor.

This continued until a late period, when Telford and Macadam brought scientific principles and regular system to the construction and repair of roads in that country.

Both insisted on through drainage and on the use of carefully prepared materials. This is unquestionably the proper system to be adopted in constructing roads; and it is the system now used in this country for constructing macadamized roads; and there is no good reason for not having our public roads throughout the country constructed on the same plan, except where there is a scarcity of stone, or where certain conditions or circumstances render such construction impracticable. It is not urged that roads should be constructed as elaborately, as regular, well finished and beautiful macadamized roads in the large cities of this State are constructed. No one expects them to equal the "Appian Way" in Rome, a magnificent highway and exceedingly expensive

But we do say that roads can be made under that system at such moderate cost as would justify most of the townships in this Commonwealth to construct the roads upon the macadamized plan.

It does not follow, that because a sample of something new and useful is expensively made, that a cheaper construction of the same article cannot contain the sample principle. A silver watch costing, $25, may contain the same movement as an elaborately carved gold watch, costing $150 contains, and so with a public road in the country, it may not be as wide and finely finished as one in or about our large cities, and yet may be laid out and made according to the same plan, and answer the same purpose for a great deal less money.

The road surface should have just enough convexity to throw the water off freely; and a very moderate amount is sufficient where good surface is maintained.

On a too convex surface the traffic keeps to the middle and wears ruts which retain the water, so that the surface is not so dry as with a flatter section, which allows the travel to distribute itself over the whole width of the road. The side ditches should be deep enough to thoroughly drain the foundation of the road, and cross drains under the road communicating with the side ditches may be required in wet soil or low places.

The thickness to be given to a road made altogether of broken stones, will depend on the traffic it is intended for. On a good, well-drained soil, a thickness of six inches will make an excellent road for ordinary traffic. The material should be graded in size, the fine portion to act as binding material. The binding, fine gravel, sand or road

scrapings, should be spread over the surface after the broken stone is laid, and should not be mixed with it.

Raking would aid in uniform consolidation. Whenever it is possible a new road should be finished with a roller. By doing so the materials are consolidated with less waste, and wear and tear of vehicles and horses are saved.

The objection urged against this system of road construction is the cost, which objection, I know, prevails to a large extent and prevents the adoption of the system which I have laid down, because people infer, as I have before said, that because some elaborately-constructed road under this system has cost a large sum of money, therefore any other road made under the same system must necessarily be just as expensive. I feel assured that if the taxpayers could be persuaded to make macadamized roads, and be willing to contribute money for that purpose, they would be amply paid in comfort and convenience which they would derive from traveling over smooth and dry roads instead of wading and tugging through mud. And the fact that roads constructed upon the plan suggested would cost so much less for repairs than roads made in the ordinary and accustomed way, should be an argument in their favor. On other subjects the reasoning is different. The difference of cost between a threshing flail and threshing machine, between a scythe and mower, between a grain cradle and reaper, and between a hoe and corn planter, is no longer a barrier to agricultural pursuits.

Upon the same principle, and in the same ratio of increased expenditure of money, we can have good and solid roads.

Mr. Satterthwaite, of my county, and whom most, if not all, the members of the Board know, and who is good authority on this question, because all the roads in that section of Montgomery county are macadamized, at a meeting of this Board, held at Bloomsburg in December, 1885, said: "We find that it pays to macadamize the roads, and our people would not like to be restricted to a tax of seven mills, because sometimes we want to spend a great deal more than that. We have learned that it pays to make good roads no matter what they cost. Everybody says, 'if you will make the roads good we do not care for the tax.' It is when you have nothing to show for the money expended that they complain, which is the objection to this working-out system."

It would be unnecessary, and, I may say, unreasonable, for any township to undertake to construct the roads on the macadamized system at once; for that, I admit, would involve a cost that would become burdensome; but why not macadamize a portion of road each year, and continue the improvement from year to year until the roads throughout the entire district have become macadamized highways.

It is a difficult matter to account for the American independence about public roads, and I venture to say that upon no other question affecting the public convenience and comfort has there been less progress. The majority of the people do not regard good roads as a luxury, and are satisfied if they are simply passable.

The early colonial or frontier state of mind still prevails too largely; namely, that a road is good enough if it is only practicable to vehicles; that is, if there are no holes or rocks in it sufficiently formidable to upset a carriage.

One has only to go a few miles out of any of our large cities to find the roads in every direction, with few exceptions, being repaired, as to

material, in the exact manner in which they were repaired by struggling colonists between 1630 and 1700; that is, nothing is attempted beyond filling up the holes with any material at hand, and affording facilities for the water to run off. The material that is at hand is, of course, the mud or compost of the adjacent ditch. This is shoveled up and deposited all along the center, filling up the cavities and hiding from view the projecting rocks.

In districts in which gravel or clay is obtained and used in this way the result is often satisfactory enough; but, as a general rule, the contents of the ditch are simply mud or decayed vegetable matter, fit only for manure. Spread over the road as a plaster, it rapidly becomes dust, and is swept away by the wind, or else becomes mud and is washed back again into the ditch, or down into the hollow in which, in wet weather, it forms a kind of quagmire, through which horses must toil with much effort and weariness.

The "dirt road" can hardly be reformed; it ought to go altogether.

As to the shape and surface condition of the public roads, except where dirt material only is used, they have been improved by means of the road machine. The same methods as to convexity and surface drainage are being adopted as are used upon macadamized roads, and, to some extent at least, incompetent and inefficient labor upon roads is rejected. To properly repair roads requires the labor of strong men —men of care and judgment, men who will properly distribute the material over the road. It is a very common fault with supervisors to allow all the dirt that is plowed and scraped from the sides of the road and from the ditches, together with stones, to be thrown into the middle of the road, making it too high in that part of the road. When that is the case, the teams necessarily pass on the highest part of the road, cutting ruts and forming ridges, which retain the water; but where the center of the road is kept down, so as to permit travel over the entire width of the road, no ruts are made, and the road during the summer and autumn seasons is in fair condition if there is frequent rain to prevent dust. The repairing of roads should be attended to when needed, and not only in the spring of the year, as has been the custom for all past time. It is of the utmost importance to have the public roads repaired at least twice a year—in the spring and fall. If they were macadamized, such necessity would not exist; but since the introduction of the road machine there should be no difficulty to repair roads readily when needed. In this respect, so far as the appliances for mending roads are concerned, there has been great improvement, and the roads can easily be kept in good repair and satisfactory condition, except during winter and spring, when no road except the macadamized road can be of satisfactory use.

Some encouragement has come from the last Legislature, when it passed an act authorizing road commissioners and other officers having in charge the opening, constructing and repairing of public roads, highways and bridges in any township in this Commonwealth, at their option, to purchase for the use of their respective districts plows, scrapers, road machines and such other implements and materials as may from time to time be found necessary in the opening, constructing and repairing of said roads, highways and bridges. They are also authorized by this act to collect annually in cash not exceeding twenty-five per centum of the rates or assessments by them respectively laid in each year for road purposes, such cash to be collected in the same manner as other road taxes, not worked out, are by law collected.

With such power given by law to the proper authorities, we have a right to expect improvement in the condition of the public roads, particularly where the roads are in charge of competent and progressive supervisors.

I believe that we all agree as to the system under which our roads should be constructed and the methods that should be employed to keep them in proper repair.

And it devolves upon supervisors under the present road law to construct and maintain good roads as far as the taxpayers will permit them to do so. The law now in force provides "that supervisors shall have power, and they are hereby enjoined and required, at the expense of the respective townships, to purchase wood, timber and all other materials necessary for the purpose of making, maintaining and repairing the public roads or highways, and to employ, oversee and direct a sufficient number of laborers to execute promptly and effectually the provisions of the law." It further provides "that supervisors shall have full power and authority, within their respective townships, to enter upon any land or inclosure lying near to the said road, and dig, gather and carry upon said roads any stone, sand or gravel found on the same which they may think necessary for the purpose of making, maintaining or repairing said roads." Now, the law distinctly and clearly empowers supervisors to do just what we want done; and if they were more aggressive and courageous in their road work, there would be less cause for complaint. If they realized the authority which they possess under the road statutes of Pennsylvania, and could fully contemplate the importance of their work and know the duties which they owe the people whom they serve, they would maintain better roads for public travel than people generally are privileged to enjoy. And while we have reason to blame the supervisors for superficial and temporary road making, we, at the same time, cannot exonerate the taxpayers. As a rule, they are too ready to grumble when they are called upon to pay road taxes, and are extremely parsimonious in matters pertaining to the public good.

To educate people to the importance of adopting a system of work or public policy, or espousing a cause involving advanced ideas, is work that generally requires much argument and persistent effort, particularly when money is required for the accomplishment of the object.

Such is the situation in the matter of improving the condition of the public roads. Whilst we might have, and doubtless should have, a better road law than the one now in force, one that would relinquish statute labor and seem to insure what is desired to be secured, yet if the construction and repairing of the roads would be made more costly thereby, the result would be about as fruitless as it is under the present law, just because the people, from penuriousness and indifference, will neither regard nor enforce the law as it should be regarded and enforced. I believe that our hope for good roads is better fixed in the gradual enlightenment of the people and in their favorable action in the right direction upon this question than to expect the reform and improvement sought after from any act that the General Assembly of the State might pass.

Observation and experience prove that it is a very difficult matter to secure such a road law as would be generally acceptable. And therefore this work must be begun and carried forward by the citizens of the different townships in the counties of the State. By trying to

convince the people of the necessity of road improvement; by exemplifying it here and there, as it is done by the people in some districts of the State now, much will be accomplished in the road issue. When people have learned the advantage and benefit of good roads, and are willing to make some sacrifices for their improvement, as they do in other causes, and when supervisors comprehend their duties under the law and perform them, then will our hopes and expectations be realized in the engagement of safe, durable and comfortable public roads.

DOES FARMING PAY IN PENNSYLVANIA?

By M. W. OLIVER, *member from Crawford.*

It cannot be denied that the real wealth of this country is its arable lands—the essential industry is farming. The general fact that agriculture is the main dependence of the human race is peculiarly true of our own country, since so large a part of it is adapted to agriculture. It is not an idle figure of speech which describes some portions of it as the "garden of the world." From the great Mississippi valley, from its broad and fertile fields, comes the corn and wheat for man and beast in the more populous and less fertile Middle and New England States, and even for people on the other side of the Atlantic. Of the many very important interests in this great and growing country, no single one is independent of those surrounding it. Of these interests agriculture is the most important. Failure upon the farm brings financial distress to every business enterprise, while abundant harvests insure great national prosperity, kindle the fires in the workshop, unchain the wheels and spread the sails of commerce, bring plenty and good cheer to the home of the laborer, and success and prosperity to manufacturers and business men. Agriculture, we repeat, is the foundation of all prosperity. It should, therefore, be carefully protected and judiciously fostered. Men in almost every profession and business have their associations and use their combined strength to protect their financial and other interests. If agriculture is protected and fostered it must be by the farmers themselves. This is as it should be. Those who have selected this noble pursuit as their life work should be willing to devote their energies to secure its fullest development.

There is no profession where so many of its members decry their occupation as do the farmers themselves. The continued complaint is that farming does not pay; that it does not yield three, no, not even two per cent. on the money invested. These fail to count all the advantages they possess. They have comfortable homes and consume many of the luxuries without making any account of them, which mechanics and shopkeepers have to use sparingly and pay for in money. We heard a farmer complain that he had worked hard twenty years and "had made nothing; his work was as good as thrown away." Had he raised a family? "Yes; he had brought up six children." Had he schooled them? "Yes; they had a fair education." Had they lived comfortably and had enough to eat and to wear? "Certainly. Of course they had." And yet this farmer claimed he had worked hard and made nothing. He had brought up, educated and given a

comfortable home and living for this family of eight. Could he have bought all the comforts his family enjoyed, schooled his children and have given them a home with a salary of less than a thousand dollars annually. When all these enjoyments and advantages are taken into proper consideration, then it will be admitted that farming in Pennsylvania, as well as everywhere else, is a much better business than many have come to believe. I know there are many who have become impatient and restless of toil, are seeking lands in the great south-west, where they expect to produce crops simply by putting the seed in the ground. If the mere sowing of seed upon virgin soil, and gathering and selling the harvest without making the first effort towards leaving that soil as fertile as we found it is agriculture, then I admit that Pennsylvania is no place for farming nor for farmers, and the sooner we leave its borders, or take up some other form of industry, the better it will be for us. Far too many, if judged by their works, have no higher idea concerning the occupation of the farmer that this, and it is from taking such a view that so large a portion of the country has been overrun and despoiled of its fertility, just as a drove of village boys often overrun and strip a fruit tree of its fruit, breaking off its branches and so prevent its bearing much of a crop the following year.

As I understand the meaning of the term agriculture, it is something more than the mere scattering of seeds and the harvesting of crops. A good farmer will no more think of letting his land become exhausted of its fertility than would a good engineer think of using up all his steam and then letting his fire go out because it requires an effort and an expense to keep fuel on his grates; no more than would a good manufacturer think of using up all his stock of raw material and then closing his factory. Good farming everywhere means good husbandry, and good husbandry means thrift and economy in the use of raw material; but by far too many have been using up the raw material in the shape of the natural fertility of the soil.

Robbery is an unpleasant term to apply to our American agriculture, but it is a term not wholly inappropriate to the history of our tobacco fields, cotton plantations, corn and wheat fields. Like the youthful robbers of our fruit trees, we have been scrambling over this great country in search of the best pickings, and while stripping the earth of its spontaneous products, have been almost criminally negligent of the duties we owe to posterity.

True it is nature erects no barriers to keep men forever on the spot where they were born. On the contrary, her methods rather invite explorations and the occupation by her children of new territory, whether these children be weeds, fruits, animals or man. And it is in violation of no natural law that each seeks for the most desirable location within his knowledge or power of attainment.

If all our farming operations were conducted as scientifically as we sometimes imagine the farming of our more advanced agricultural writers to be done, what a fair face Pennsylvania's farms and farmers would present.

As we have before intimated every farmer should know what he is doing. Intelligence, as well as muscle, is good capital to be invested with. We ought to know where the profit is in all our farm operations. Does the farmer study this, or does he toil day after day, giving no thought of the result, whether it will end in profit or loss. One reason why farming everywhere is credited with such small rates of

profit is because farmers fail to keep correct accounts, or oftener, not any at all. They spend all they make, and then, because there is nothing left, claim they have made nothing. Pennsylvania has hundreds of farms, stocked with animals and farm implements, which would not bring in market three thousand dollars, the interest on which, at present ruling rates for property well secured, would not bring more than two hundred dollars. Now, what kind of a living would an annuity of two hundred dollars give even a small family? And yet on a capital of three thousand dollars, invested in a Pennsylvania farm, whole families obtain good livings, keep the principal secure, educate the children, ride to church, and have their own way generally about things, more so than is possible among any other class using the same amount of capital in their business. And yet a majority of these small farms, or, rather, low-priced farms—for many of them contain fifty, and even an hundred acres each—are not half worked, no, not a quarter. And here we would ask, does any one know of a farm anywhere that is worked to its full capacity? Has any one yet found the limit to the profitable working of a single acre? I remarked at the outset that in my opinion farming in Pennsylvania is a much better business than many have been inclined to believe. Except in the single article of milk and its products, we seem to have less competition among ourselves than is found in any other business that is unguarded by combination for mutual protection. We have excellent markets, even at our very doors; and it has been shown over and over again that an acre of good, well-tilled land here will produce as bountifully as will an acre in the West, while the crop grown will sell for a good deal more money.

From different parts of the State we hear farmers remark that their farms have paid them a yearly net profit of seven, eight and even ten per cent. on their cost. This, for these times, and with land at from fifty to one hundred dollars per acre, is evidence enough that in Pennsylvania farming can be made and is profitable. It is not upon the largest farms that the most money is usually made. Not one farmer in ten can make as large a percentage on two hundred acres as he can on half that amount. A great many hundred-acre farmers have twice as much land as they can or do cultivate. For all such a reduction of their farms, to bring them down to the capital and labor employed, would be an advantage. Yet, where money and labor can be had, the larger the farm, usually the greater the profit. In order to have profit accrue in farming it is necessary that all the capital be employed, and in the case of farmers, land is their capital. It should all be worked and be made to produce paying crops. This, on good land, is not difficult. There are farmers who, on a few acres, will make twenty, thirty, or fifty dollars profit per acre. If their entire farm produced in like ratio, they would soon be rich; yet they barely make both ends meet at the end of the year. The secret of profitable farming is to make the most of every acre, having, of course, due regard to maintaining the fertility of the soil. I have said it was not an idle figure of speech which describes some portions of our country as the "Garden of the World." Being in possession of so genial a climate and so rich a soil, it would seem that our productions ought to lead those countries less favorably situated. Comparing the wheat crop of eight of the leading wheat growing States with that of Ontario, Canada, we find that the average yield for the past five years in Ohio is $13\frac{1}{25}$ bushels; Michigan, $15\frac{9}{10}$ bushels; Indiana, $13\frac{2}{25}$ bushels; Illi-

nois, $12\frac{9}{50}$ bushels; New York, $15\frac{37}{50}$ bushels; Pennsylvania, $13\frac{2}{5}$ bushels, while that of Ontario is $21\frac{4}{25}$ bushels. Of spring wheat Iowa's average yield for the same time is 12 bushels, Minnesota's $13\frac{17}{50}$ bushels, while that of Ontarior is $16\frac{6}{25}$ bushels. Of barley the average for the eight States, to wit, Ohio, Michigan, Indiana, Illinois, New York, Pennsylvania, Iowa and Minnesota, is $22\frac{1}{8}$ bushels, while that of Ontario is $26\frac{22}{25}$ bushels. Ontario takes the lead in the average of her oat crop, for the same time compared with the same States, her average being $37\frac{9}{25}$ bushels, while that of Minnesota, having the largest average of the eight States named, being but $36\frac{11}{50}$ bushels. The above averages are computed from reports of threshers and reports to departments of agriculture. Why this adverse showing? It certainly is not that we have a poorer soil and climate. Shall we confess that our average system of agriculture is inferior to that of the province with which these comparisons are made? Let us give an illustration how this difference may occur. Two brother farmers are upon adjoining farms, soil the same, and apparently they work and manage alike. The difference in the yield of the crops is but trifling, yet one is gaining steadily in wealth while the other is just as steadily running in debt. How is this? The first manages to have his crops good enough to pay expenses and a little more. If he raises a crop of wheat he is careful to have it come out a little in advance of expenses. Perhaps it is but one bushel per acre above all expenses, yet this is net profit. If he has forty acres, it leaves him forty bushels, at one dollar, which gives him forty dollars net profit on his wheat. If he feeds cattle for market, he so manages that his receipts are more than the expenses, and so on through all his farm operations. His profits are always on the right side of the balance sheet. How is it with his neighbor? He sows as much wheat, his expenses are no more than the other, yet by some mismanagement—perhaps there was a weak spot in the fence and the cattle have walked in and destroyed so much that his crop does not yield as much into two bushels per acre as does neighbor A's. If he feeds cattle his barn is so open that cold takes off the fat almost as fast as it is put on. B's wheat was grown at a loss, trifling it may be, yet surely so with his beeves. They are marketed with the profit on the wrong side of the balance sheet. The difference in the yield of wheat was so little B thought it made no difference and made no effort to stop the leak; and with his stock feeding he pursued the same course. This difference, though small on each acre of wheat grown, as well as on each bullock sold, yet in the aggregate it told a great deal. It is said of the one that he was on the road to affluence, and of the other that he was on the road to want.

A goodly number of the men on the farms of this State are there, not from personal choice, but because circumstances over which they apparently have had but little control have influenced them. A part ownership in an inherited farm has tempted, yea, almost compelled many to try their hand at the business, who have little love and less of that training necessary to the highest success in any business. Many among this class would doubtless have made excellent mechanics had they been early encouraged and trained in that direction, and it seems a pity that good mechanics should have been spoiled to make such indifferent farmers.

I apprehend that a very large proportion of the grumbling and depreciatory expressions concerning farming have come from this class of farmers, who were made farmers against their choice. What this

great State of Pennsylvania now needs is, not more compulsory farmers, nor shiftless farmers, but more of scientific farming, and I may add fancy farming likewise.

I know there is much contempt expressed by many towards the fancy farmer. True, it is, they have made many mistakes, but they have been mostly at his own expense. It is this class of farmers who make farming a study from a business standpoint. He purchases the best stock and experiments with the most improved implements; he introduces new varieties of grains, vegetables and fruits; he studies the improved methods of other nations and takes notes of the weak points in our domestic systems, and possessing true patriotism as well as business ability, he strives to inculcate his new ideas into the minds of friends and associates. To the so-called fancy farmer we are indebted in a large degree indirectly, if not directly, for the dissemination of all our new breeds of domestic animals and the endless variety of valuable labor-saving implements of tillage now deemed so indispensable in all the more advanced system of modern agriculture. Those who claim to be practical farmers have much to thank the fancy farmer for and very little to charge against them.

Scientific farming is comparatively a modern term variously applied by different persons to styles of farming supposed to be a little better than their own, but deemed unattainable except by those who can combine learning with wealth. The term "scientific" rather scares common farmers, as though there was some deep mystery involved in it, but if we would remember that the sole office of science is to unfold and explain things, to deal with causes and effects, and that science is only classified knowledge, or as some have expressed it, the sum of known truths pertaining to different subjects. We need to have no hesitation about grasping all the agriculture science possible. That farmer who has learned enough about the habits of the insects which attack his grain and his fruits so that he can forestall them in their mischief, is to that extent a scientific farmer. If he understands enough about the laws of health to be able to keep his animals thrifty or to treat them properly in sickness, he is still more a scientific farmer. If he understands the theory of plant growth, how the roots get their food from the soil and knows how to economically enrich that soil so that it shall continue productive, that knowledge is scientific knowledge. Scientific farming is only another name for intelligent farming, and no one at this late day will have a single word to utter against intelligence as a necessity in profitable farming,

American farmers, and I believe Americans generally, have been called a race of grumblers, except when making or listening to spread-eagle speeches; but it must be remembered that grumbling in a free country is only the first step towards setting wrong things right. That the farmers, in fact the citizens in general, in not only this State but in all the States, have just cause for complaint from the great railroad corporation of this country, no sane person can deny. When the laboring millions of Europe are supplied with bread from the great grain fields of this country at a less cost than the people of our own towns and cities can obtain theirs, grumbling is a mild term to apply to our cause for complaint. While these trunk lines are allowed and do transport flour and wheat from Chicago to Liverpool at a less rate than they will deliver it at any of our inland towns or seaboard cities on the route, or while they are allowed to charge more for the short distance than for the longer, just so long are the railroads going to dic-

tate to the farmers just what shall be paid for our products. We would not forget the untold blessings which the railroads have brought us. We would have them continue a blessing to the whole people and not for the few alone.

Our progress as a thoroughly self-supporting and self-governing people may at times seem slow, but when we look about over our hill sides and compare even our poorer homes with the homes of the average laborer in almost any other part of the world, and again when we find the leading men of other nations coming to us for patterns by which to improve the condition of their own people, and to reform their own methods of government and of education, when we bear in mind all this, if we can only be sure that our progress is real and in the right direction we may congratulate ourselves that the gain is not ours alone, but that an influence is being exerted that is reaching out towards the corners of the earth, and that instead of the little paradise of a garden and republic which our fathers in their imagination and exclusiveness might have seen developing on the shores of this New World, the farmers of this country and their descendents are rearing a structure which must hasten the time when every honest and industrious worker can, if he chooses, own a house and land and be respected, not only in America, but wherever the name of America is known.

HOME LIFE ON THE FARM.

By Dr. WILLIAM S. ROLAND, *member from York.*

Poets have sung, orators declaimed, editors written in eulogy of agricultural life; its usefulness, its independence, its nobility, its happiness, and the prosperous success which usually attends its people in their various enterprises, pursuits and occupations—as to convince the most skeptical, that there is a charm surrounding home life on the farm, pleasant and beautiful to contemplate; and yet in these latter years, both observation and experience show a growing reluctance among our young men and maidens—born and brought up on the farm—to engage in agricultural pursuits. Time was when the farmer's son found his highest ambition gratified in the possession and management of a farm equal to his fathers; when the daughter sought no better and happier lot than her mother's to preside over a neat dairy, or well-appointed and managed farm house, amid the charms of country life. All that has strangely changed. The country boy will not endure the idea of farm life, but flies off to town at the moment of emancipation from parental control, and engages often in harder labor, and at less remuneration, than would have been his lot on the farm. The daughter engages in school teaching or sewing, or some other more exacting labor in preference to the household avocations of a farmer's wife and daughter; and yet it is a strange paradox that the town tradesman, whose life has been spent amid the cares and worries and turmoil of city life, earnestly longs for, and strives for a country home and rural surroundings for his old days retirement and his children's education. Now why do the country boy and girl turn with aversion amounting to disgust from the paternal home and employment? It is undoubtedly due partly to the prevailing idea that other avocations and employ-

ments merely afford a surer and speedier road to the acquisition of wealth and distinction. This is surely a great mistake. The spirit of improvement in agriculture has advanced so rapidly that education with the farmers has become a pressing necessity. That to keep up with the times brains are just as essential as muscle, and agricultural societies, State boards of agriculture, farmers' institutes and home agricultural publications, are all busy sowing the seeds of social culture and intellectual training. These associations, opportunities and advantages are well calculated to stimulate and nerve the farmer to care for his family, his home and his farm; and it is but fair to say, that the time is now here, when the ambitious, desiring to succeed in social and intellectual attainments, and take honorable position in society, are not compelled to leave the farm for other professions and occupations, already more than full, for the quality and standing of any honorable calling can only be measured by the character of the men and women engaged in it; and no system can so well bring boys and girls up to the required standard, as for them to stay at home and improve their minds in moral, social and intellectual culture, for under such training they can only become the equals in intelligence with any other known class of respectable scientists in the country. "The noblest mind, the best contentment has." The place called home should be adorned and attractive in all its surroundings—for he only, who has a home to love and a home to defend—can best do his duty to himself, his family and his country.

Judge Farrar's of Virginia, says:

"Magnify as you please the laws and the Constitution, it is the strong home feeling that gives the potent influence. The man who has a spot on earth where he planted a tree, or his wife has nursed a flower, will in the hour of trial evince a heroism that will put to shame the hollow pretensions of all the blatant politicians in the land." Added to this is the happiness and independence enjoyed in the possession of a home that you can call your own. When beholding the beauties of nature, the everlasting hills and lovely valleys, carpeted with living green; the whole richly colored with the full blooming fruit trees or their bending boughs loaded with growing, ripening fruits, to which the lofty oak, spreading chestnut, the pines and cedars lend a pleasing shading; or of other fields covered with growing and maturing crops of waving grain or corn, while in other fields are noticed herds of lowing, patient cattle, neighing horses and gamboling sheep, and of the brooks and rivulets by the way.

> "It is a goodly sight to see,
> What heaven has done for this delicious land,
> What fruits of fragrance blush on every tree,
> What goodly prospects o'er the hills expand."

But it would require a poet's pen to enlarge upon and do the subject justice; therefore I reluctantly turn from these beautiful and interesting landscape scenes to visit the home of the farmer. Here, as I enter, I find the happy, matronly mother of the house with her rosy-cheeked, healthy-looking daughters, all neatly and comfortably clad, contented and bearing the impress of education and training as to make them fit to mate with the most respected and honored in the land. But what of the father and sons of this happy home? Ah! here we see them coming from the fields where they have been toiling from early morn. The great, broad-shouldered father followed by his stalwart sons and younger lads, all bearing evidences of toil, as well

as the smile of happy contentment. As soon as they arrive at the house, they immediately seek the pump or spring and plunge their sunbrowned hands and flushed faces into the cooling waters, God's purest gift to man. After having completed their ablution, they enter the neat and well provided kitchen or dining hall and sit down to a table well loaded with beautiful fruits, produced by their own industry and on their own farm; then, after they have bowed their heads and the father and head of the family has offered his humble but earnest benediction to his and their God, they enjoy a more happy meal than was ever eaten in lordly hall. Then when the frosts of autumn approach and denude the trees and shrubbery of their rich foliage, the work of the farmer for the season of planting, sowing, husking and garnering is practically over. The wheat, oats and corn have been garnered or sent to market; the apples have been picked, cider made and apple butter boiled; the horses, cattle, sheep and swine comfortably housed; then, when the fire wood is prepared and the daily chores are done, there is little for the farmers to do.

The smaller children are sent to school, and the older ones are found at some useful employment, and when the early shades of evening shut down on the world, this happy family is found seated around the cheerful blaze of the hearth fire or warm stoves; the father dozing in his arm chair, whilst one of the sons reads aloud, and the happy mother and bright cheerful daughters are employed on the necessary needle or knitting work for the family. Then, when the snows of winter fall, and the singing and spelling schools, or the industrial institutes are in full operation, the boys bring out a team of sleek horses, hitch them to the big sleigh or sled, and away they go with song and laughter, as bright and merry as the tinkling bells. Thus they enjoy themselves until early spring again sends them back to their daily work.

"How one loves to revel in the memories of by-gone days. Associations come drifting down the years in romantic and picturesque beauty. We ask, will such ages come again? The present is too real to be romantic; too practical to be poetic. In this age of unrest and excitement, more than ever do men look back, but in vain. The eras that have gone have gone forever. Life is a stream ever flowing onward. The river broadens and deepens and changes."

As does the ways of the ever busy world. The problem of providing adequate means for the employment of a large and increasing population is a mystery of somewhat difficult solution that must engage the attention of statesmen, economists, humanitarians and other classes and associations to discuss and work out the answer. Whilst there seems to be but little hopes to secure permanent employment in the various avocations of commerce, or in the factories and work shops of the cities and towns, there is still room for many idle thousands in the farming interests, where, by patient and honest industry, they can secure for life a home on the farm.

The picture we have drawn of the farmer's home life is somewhat ideal. It is rather what that life should be than what it too often is. Perhaps in the strong contrast which the actualities of moral life in most instances present to the scenes we have depicted, may be found a potent influence in turning our young men and maidens from the farm and dairy to the excitements and dissipations of town and city life. The life of the farmer's son and daughter is too often made one of unceasing toil; no opportunity for pleasure, recreation or mental

improvement is allowed; none but the barest rudiments of education are afforded. The mind remains uncultured, the better and higher tastes undeveloped. The home is destitute of ornament, of beauty, of aught that can attract or gratify even the lowest and least developed perception or the fitness of things. The bare necessity of an almost entirely animal existence are all that it is deemed necessary to supply to the farmer's family. They are often no better fed and housed (sometimes worse) than his horses, mules and cattle. The object seems to be to get out of them all the physical labor they are capable of performing, with no thought or care for their mental nature, and no desire to gratify that love of beauty, pleasure and enjoyment which the Creator has implanted in every human being. The picture is not a pleasant one, but is too often realized in moral life. No wonder that the sons and daughters revolt from such an existence and fly to other pursuits, which they fondly imagine, if requiring no less toil, will be passed amid more congenial surroundings. No wonder that the town bar and the saloon, the haunts of vice and dissipation in cities, attract so strongly the country-bred youth, who has grown up amid the dreary surroundings we have depicted. No wonder your daughters find the ball room and dance house a paradise in contrast. You have not cultivated any higher taste; you have systematically refused to gratify such as nature has implanted. The remedy is in making home life on the farm—what it is pre-eminently capable of being made—the happiest life in the world.

Give your sons and daughters the best and highest education your means can command, they will find that agricultural pursuits to be successfully conducted will fully employ the highest talents and the largest mental gifts. With education and cultivation will come an enlarging and elevating of the tastes and capacities for pleasure. These must be gratified; books, pictures, music, all that goes to make up the æsthetic side of life and to gratify fine tastes will serve to make home happy, and to make the young reluctant instead of anxious to leave its sacred precincts. But it may be said that but few farmers can afford to educate their children, and gratify their tastes, and ornament their houses. Something in this direction can be done by every man, however poor, and the young themselves, if they find that encouragement which they should receive, will aid in the work. Give your children at home all the means of innocent enjoyment and recreation in your power; by education enlarge their mental horizon; by the cultivation which follows widen and elevate their tastes; then, so far as in your power lies, make home the center where the tastes thus created find their highest gratification, and the demand for intellectual pabulum finds stores of learning and literature at its command, and you will make each farmer's home a delight to its inmates, and a center from which radiates beneficient influences on all within its circle.

SOME THINGS THAT FARMERS SHOULD TAKE GREATER INTEREST IN AND WHY.

By Hon. WM. GATES, *member from Venango county.*

The object of this paper is not for the purpose of giving information, but to try and impress upon the farmer the importance of his calling and the improvement of his home. Success does not depend

so much on the occupation as on the man. It matters but little what occupation a man chooses, he succeeds on certain conditions, and these are alike applicable to all vocations, viz: A natural tact or taste, an aggressive nature, a good management, plenty of push, energy and good judgment. With these a man will succeed anywhere, without them he will not. With the same amount of capital invested and possessing the above qualifications, a man will succeed just as well in one calling as another, I care not whether he be a drayman, a carpenter, farmer, merchant, lawyer or physician; and no one of these callings is so free from petty annoyances, none so free from uncertainties and losses as farming, and none promises so much independence, so much leisure or so many luxuries. It is not the man who expends the most manual labor and denies himself and family of the most comforts who succeeds best in any calling. It is he who does the best managing, who furnishes the most skill and brain power, who lead in any profession. There is very close competition on the lower rounds of the ladder, but as we ascend the ladder competition becomes less and less, until the man on the topmost round enjoys almost a monopoly. If you would enjoy a long, peaceful, happy life, one comparatively free from petty annoyances, and one in which you will find most leisure for mental and social improvement, and one in which you can enjoy your evenings with your family, I would advise you to stick to your farms, remembering that success in life does not depend alone on the amount of money we accumulate, but upon the amount of development we can bring to ourselves, and the good we can do to others. Since the organization of this Board of Agriculture, nine years ago, nearly every question in relation to agricultural pursuits has been presented, discussed and printed in the quarterly and annual reports, and distributed among the farmers of the State. The information thus given, together with county and local societies, has made its mark throughout the State. This nation has a serious problem to settle. We are living too fast. The rich spend their money to make a show and create a distinction, and try to elevate themselves above the laboring class. The poor, being dependent on their labor for a subsistance, have organized to protect their labor. Hence strikes, lockouts, socialism and anarchism is increasing, and security in life and property seems to be in danger. Society is drifting in the wrong direction. The dividing line is money, and not merit. The servant is driven to the kitchen, and not permitted to appear in the company of guests, nor eat at the table with the family. To remedy approaching danger, there should be a strong effort made to induce every man to secure a home of his own. There can be no such thing, in the highest sense, as a home, unless you own it. There must be an incentive to plant trees, to beautify grounds, to preserve and improve. It elevates a man to own a home. It gives a certain independence, a force of character that is obtained in no other way. Homes make patriots. He who has sat by his own fireside, with wife and children, will defend it. When he hears the word country pronounced, he thinks of his home. Few men have been patriotic enough to shoulder a musket in defence of a boarding house. The prosperity of our country depend upon the number of our people who are the owners of homes. Contrast the difference between France and Ireland. In the former, the occupants are owners of the soil, and peace, contentment and prosperity prevails. In the latter general discontent, rebelling against landlords in demanding their rents. The

same feeling exists here, hence the necessity to encourage every man to own his own home.

Bring up your sons to be independent, through labor to pursue some business for themselves. Give them a colt or some other animal as their own, and when sold, do not pocket the money yourself, but give the boys a show to trade for themselves. Give them a piece of ground to cultivate in some kind of a crop, and offer a premium for the best yield. When you go to the field say: "Come, boys!" Give them the best tools to work with, and don't scold and find fault with their work, but encourage them to try and do everything in the best manner. It is a well-established fact that rural homes are the best to bring up good men and women. The duties required learn them habits of industry, and their services are sought after at home and in the city. A good education is necessary to make intelligent successful farmers, but we must get rid of the idea that a little education unfits one for work. There are hundreds of graduates of colleges who are performing some kind of menial service. They seem willing to do anything that is not regarded as work—anything that can be done in a city, in the house or in an office, but they avoid farming as they would leprosy. Nearly every young man educated in this way is simply ruined. Such an education ought to be called ignorance. It is better to have common sense without education than education without the sense. Boys and girls should be educated to help themselves. They should be taught that it is disgraceful to be idle and dishonorable to be useless. You can divide mankind into two classes—the laborer and the idlers—the supporters and supported—the honest and dishonest. Every man is dishonest who lives upon the unpaid labors of others. All laborers should be brothers, and every farmer should consider every man who labors with either hand or brain as his brother. Before genius and labor formed a partnership there was no such thing as prosperity among farmers. Every reaper and mower, every agricultural implement has elevated the work of the farmer, and his vocation grows grander with every invention. There is a quiet independence about the life of a farmer that no other business or profession can promise. He goes, as it were, into partnership with nature. He lives with trees and flowers. He breathes the sweet air of the fields. There is no constant strain on his mind. His nights are filled with sleep and rest. He watches his flocks and herds as they feed on the green pastures. He hears the pleasant showers falling upon the waving fields of grain, and the trees he planted in youth greet him with loaded fruit.

Farmers should beautify their homes. There should be trees, flowers and running vines. Everything should be kept in order, and in all there should be the pleasant air of thrift. In every house there should be a bath room. When you come from the field tired and covered with dust, nothing is so refreshing. Above all things, keep clean. There is no necessity to be filthy to raise products from the soil. I have very much respect for a farmer who does honor his calling enough to try and keep his smartest sons on the farm and make useful men of them rather than send them to college to make professional gentlemen who produce nothing, but by sharp practices live upon the duplicity of the honest toiler. When this country was first settled the pioneer farmer had many hardships to endure. There was nothing but wild beasts and wild Indians. The forests had to be cut down and timber that would now be valuable burned up and the land cleared, and nothing but rude implements to work with. Log cabins

were the best that could be afforded—no roads, no schools, no churches, but it is hard to realize the improvements that have been made within the last fifty years, and the time is now here when farmers must take a seat at the head of the table, and why? For the reason that they raise the food to feed all, the material to clothe all, and furnish three-fourths of our exports to foreign countries. Were it not for the farmer manufactories could not be run with a profit, railroads would be idle and cities crumble to dust.

AN INQUIRY INTO THE RESULTS OF THE ARTIFICIAL PROPAGATION OF FOOD FISHES IN CHESTER COUNTY.

By Dr. JOHN P. EDGE, *member-at-large, Downington, Pa.*

To enable me to secure reliable information on which to write this paper, I caused to be printed a circular with fifteen stated question to which I solicited answers. These were sent by mail to all persons in the county of whom I could hear that were interested in the growing of fish and also to a number of anglers.

I have received about thirty answers from some fifty sent. Some of these give definite answers, with valuable information, some were evasive or indefinite, giving no positive information, but nearly all showing that the attempt to grow fish in ponds had not been attended with the study and care of the fish and their habits or wants as to make it a success. A number stated that the experiment was private amusement mainly; others with the idea of having a supply of fresh fish when they desired them, and a very few seem to have entertained the idea of making a profit out of them, while a few candidly express the opinion that they might be made a source of profit if properly attended to, one or two saying that more money could be realized from a given area suited for the purpose than from any other farm industry they knew of. Others again could not see where the possible profit would come in when land was used that could be profitably farmed.

I will go over the questions in their order, giving a general summary of the answers that had information for us:

First. If correspondent has a pond or dam, when was it stocked with carp or trout or other fish, and with what number and size?

The answers all date their experience later than 1880, and all refer to carp, which were in numbers from five to one hundred or more, and in size from one and one-half inches to two inches in length when placed in the ponds. One answer says that from twenty carp two inches long, put in November 18, 1882, after the second summer he had more than he had room for in his pond. The range was not large enough for them to get sufficient food to produce rapid growth. Only fed them for amusement occasionally, on stale bread. They have paid all expenses by sales and have afforded much amusement. Had eaten from seventy-five to one hundred pounds per annum, of satisfactory quality.

Another correspondent says that from fifty carp three inches long put in in 1882 the increase visible had been about twenty-five thousand. Has eaten them in sizes from twelve to twenty inches long. The small are the best. Better in cold weather or when fed in fresh

water. Has sold one hundred and eighty-five dollars' worth, some as high as twenty-five cents per pound. He adds that "if he had suitable territory he could make more money on the same amount of land than on anything we raise."

Second. What has been the increase, if any, so far as known?

Some answer that they have not noticed increase. With most it has been satisfactory, as is shown by the above quotation. The secretary of the North Coventry Carp Club says that from nineteen carp four inches long put in in 1883 they have about three thousand increase.

Third. If not successful, from what cause, and what were the principal means of destruction of fish in close?

From freezing in mud and destruction by fish hawks, heron, cranes, kingfishers, snapping turtles, snakes, frogs and poachers at night with seines.

Fourth. Was a regular system of feeding practiced, and, if so, with what result?

No one seems to have fed regularly. Where not crowded they find enough food in the ponds when supplied with aquatic growths. One man, who used an abandoned quarry for a pond, says his fish did well. Was stocked in 1884 with sixty carp. The largest caught so far weighed four pounds, and they have increased greatly. Have not been fed. Quality good; thinks they would be better if fed in separate water.

Fifth. What was the principal food used?

Bread, wheat, corn, bran or middlings, boiled potatoes, blood, vegetables cut fine.

Sixth. To what extent have the fish been harvested or eaten?

Most answers do not say, but others seem to have used them to a considerable degree and with good relish. See answer to No. 2.

Seventh. What was the general quality of the food?

Answers vary, from good, very good, satisfactory; mostly very fat; flesh fine grained and sweet. One says they are too much like the common sucker.

Eighth. Were they used direct from breeding pond, or fed in separate water? Was there any difference in quality, if so fed?

Both ways. Answers vary; some could not notice much difference; most of them say the quality is much improved by feeding in clear water.

Ninth. At what cost was close or dam constructed?

Answers vary, from a few days' work with farm help in spare time, to a cash valuation of from $50 upwards to $100. The North Coventry Carp Club's pond is of 5,000 square feet surface and cost about $100. To the question, "What is the most reliable method of constructing a fish close?" they say "that in their judgment, the most reliable method is to construct the close in a situation that the stream supplying water, would not be confined by the pond. Thus avoiding the possibility of a washout in time of freshets. Earth banks entirely surrounding the pond give much more chance for growth of plants and roots from which carp can obtain much food. And when muskrats get in there is not so much trouble in getting them out as when the banks are constructed of stone or wood. We have our pond made with a sluice, and find it very satisfactory."

Tenth. What has been the observation as to the mixing of varieties? Also of different species in same water?

Those who have the leather and mirror carp in same close say they

do not find any that are mixed. Not much information was had on this head.

Eleventh. What are the possible chances of profit in breeding food fishes for the market? Give personal experience.

Several say they have paid expenses without care. Others say chances are good when properly grown. The man with the 25,000 has already been quoted, The North Coventry Carp Club say, "Very good, if conducted right."

So far as to carp. I asked also the following question, having a bearing on the subject in hand:

What has been the effect of intróducing black bass, pickerel and other carnivorous fishes into the streams of Chester county, both as to the effect on the tribes natural to our waters, and in an economic sense?

The answers, where given, vary much. On the whole they think it has been beneficial, as supplying a better quality of fish than those natural to our waters. Bass being very prolific and afford more pleasure to the angler, and not as destructive as the fishermen and turbine wheels.

Are there any streams in which brook trout are found to breed successfully? If not, what have been the causes of their disappearance?

So far as appears by the answers received, brook trout are practically a thing of the past in this section, so far as to affording either pleasure or delicious food.

Streams that thirty years ago abounded with these gamey beauties, now have none or only a few. The writer in early life was sure of a good *string* of them when he swung his hazel pole and horse hair line. and made a descent on the run in the swamp. But alas, no trout have been known there for years. And this is the fact with almost all of the trout streams of Chester county.

It is not a part of this paper to discuss the causes leading to this fact, and it only remains to say that trout, and pike or pickerel, as a means for fish food, are out in Chester county.

As to the effect of introducing new kinds of food fishes into our streams, it has been an utter failure, as applied to lake trout, salmon trout, wall-eyed salmon and all other kinds except the black bass. The effect of introducing the carniverous tribes has been to greatly reduce the supply of those native to our streams. A recent writer has aptly compared the result of this practice to that of the introduction of lions and tigers into our woodlands and forests. The result in both cases being the wiping out of the weaker races. These carnivora afford some sport for the professional angler, and the idle small boy; but as an element in the supply of food, may not be considered, as applying to the industrial classes, and as an item in the social economy of the State, had as well been kept from our streams. I do not doubt that every pound of bass caught in this county has cost a day's pay for the average day worker.

For a cheap and abundant supply of food fish, in the interior at least, our people would do well to direct more attention to the growers of the German carp.

They have been shown to be even better adapted to our eastern water than even to their native German, and not only immensely prolific but of such rapid growth and requiring so little care in feeding, as compared with the game fish, that there can be little question about the profits of growing them.

One old man of eighty years, whom I visited, told this story which I know to be true in part. He had a saw mill supplied by a *very muddy* dam. In this he put ten small carp. He did not know much about the increase, as it was an open stream. But of the ten put in nine were accounted for; seven were eaten, averaging seventeen inches, and were *good fish*. Two escaped to a lower dam and were caught, one of them measured twenty-one inches and weighed nearly eight pounds. This was after three years' growth.

Mr. Pierce in his paper in our report for 1882 asserts that there are carp in some of the Austrian preservers that are known to be one hundred and fifty years old, and others that have weighed from forty to ninety pounds. Several of my correspondents aver that in two seasons their fish have grown from two to three inches to fifteen and eighteen inches. One old gentleman says his fish grew very rapidly, and in two years after they were put in, were caught in size twenty-three inches. He adds: "It is fine sport to land one as large as a shad, with hook and line, and requires some skill to do it successfully."

Prof. S. F. Baird well says: "In fish culture we improve on nature, knowing better how to do it than does Dame Nature herself." While in the natural spawning only those seed that happen to be favorably placed are fertilized, in the artificial method almost the entire spawn may be hatched. And while but a small per cent. of those hatched in the natural waters arrive at maturity, it is possible that almost the entire spawn may be grown in artificial waters.

And when we consider the fecundity of the female fish, we get into the region of the marvelous. As in some of the salt water tribes, the Cod for instance, a single female may spawn as many as nine million of seed. The shad is not far behind her in capacity. Yet the supply of fish in our markets is steadily diminishing in its relation to population.

We may infer that to keep up a supply, it will become necessary to resort to the artificial methods, in waters free from the polution in streams that drain our vast manufacturing cities, and thickly peopled regions, not less than the disturbing effect of the navigation of our water ways.

Growing fish for food has been practiced from the days of the early Romans, who spent vast sums of money in constructing and keeping their lakes stocked with the most desirable kinds of fish for food; and the Chinese, for long ages before the Romans, appear to have understood the advantages of their cultivation.

Somewhat of the asserted value of this kind of food for brain workers has been sadly spoiled recently by the assertion of a distinguished chemist of our country, that there is more brain food in a good ripe apple than in a big fish. It will be some consolation to the man of study, who cannot afford to pay twenty-five cents for fishy brain stimulants, to have a store of fine Baldwin or Smokehouse apples within reach.

TABULATED STATEMENT OF ANALYSES OF COMMERCIAL FERTILIZERS.

Made by the Pennsylvania State Board of Agriculture during the year 1887.

From samples selected by the Secretary of the Board, or its agents, in accordance with the provisions of the act of June 28, 1879. Analyses by Prof. F. A. GENTH, University of Pennsylvania, West Philadelphia. Valuations are based upon an allowance of 8 cents per pound for soluble and reverted phosphoric acid; 5 cents for insoluble phosphoric acid from bone; 4 cents in mixed fertilizers which derive it mainly from tankage, fish, &c., and 2 cents when derived from South Carolina Rock; potash, 5 cents, and ammonia, 17 cents per pound.

All correspondence relating to the correctness of the analyses should be directed to Doctor F. A. Genth, as above; all relating to the correctness of the samples, should be directed to the Secretary of the Board at Harrisburg, Pa. Attention to this will prevent vexatious delay to correspondents.

It should be remembered that the column of "Comparative Commercial Value," is obtained by multiplying the number of pounds of each element in a ton by the market price per pound in the market at the commencement of the fertilizer year, August 1; hence, this column makes no allowance for mixing, freight, commissions, or variations in value during the year.

The reader is cautioned against making a comparison between the "Comparative Value" of this list and some of those which preceded it. The fall in the prices of fertilizer supplies has compelled us to lower the prices allowed per pound, and hence any such comparison would not only be unfair to the manufacturer, but would also mislead the reader. In making such comparisons the reader should see that the values at the heading of both lists are the same.

Complete Fertilizers.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Potash.	Ammonia.	Comparative Commercial Value per ton.	Selling Price at Point of Selection.	Sample Number.
720	Q. & L. Phosphate,	Waring Fertilizer Company, Colora, Md.,	Cedar Springs,	Mch. 15, '87	6.17	5.49	2.80	2.11	2.11	$30 18	$33 00	720
721	Royal Bone Phosphate,	Williams, Clark & Co., New York,	"	"	5.90	4.45	1.16	2.27	1.72	25 61	80 00	721
724	Ammoniated Bone Phosphate,	Henry Cope & Co., Lincoln University, Pa.,	L. University,	Mch. 23, '87	8.35	8.68	1.48	1.77	1.26	26 48	27 00	724
725	Cope's Potato Phosphate,	" " " "	"	"	6.35	8.11	5.72	1.84	2.90	27 42	29 00	725
726	Cope's Pure Bone Phosphate,	" " " "	"	"	4.04	5.96	2.64	2.15	2.66	29 80	32 00	726
727	Cope's Dead Shot Phosphate,	" " " "	"	"	5.83	2.57	0.43	2.26	1.48	20 75	24 00	727
729	Ammoniated Bone Phosphate,	Josiah Cope & Co., Lincoln University, Pa.,	"	"	5.28	3.96	4.56	1.60	1.63	25 61	27 00	729
730	Try Me Bone Phosphate,	" " " "	"	"	6.24	8.62	8.93	1.52	1.28	24 79	25 00	730
734	Complete Amm. Bone and Potash,	J. Gawthrop & Co., Kennet Square, Pa.,	Fairville,	Mch. 25, '87	3.75	8.95	8.15	7.82	2.05	29 68	28 00	734
735	Susquehanna Potato Phosphate,	Susquehanna Fertilizer Co., Baltimore, Md.,	"	"	7.46	8.18	8.48	0.48	0.90	23 80	25 00	735
736	Pioneer Raw Bone Phosphate,	J. G. Downward, Coatesville, Pa.,	Cedar Knoll,	"	6.51	8.74	2.64	2.83	2 01	27 67	83 00	736
739	Newport's Ammoniated Sol. Bone,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	Apr. 2, '87	11.78	2.28	1.80	0.46	2.85	34 09	26 00	739
740	Complete Bone Fertilizer,	Allentown Manufacturing Co., Allentown, Pa.,	Allentown,	"	7.12	2.83	1.49	1.78	2.05	25 01	35 00	740
741	Newport's Rectified Phosphate,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	"	8.38	4.87	2.55	5.44	3.34	30 24	37 00	741
743	Ammoniated Bone Phosphate,	Buffalo Fertilizer Works, Buffalo, N. Y.,	Quakertown,	"	8.23	2.80	1.25	1.83	4.14	34 05	31 00	743
745	Pure Raw Bone Phosphate,	F. W. Miller, Sellersvile, Pa.,	Sellersville,	"	5.33	8.49	1.41	2.47	1.86	24 08	37 00	745
746	Newport's German (A) Guano,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	"	8.81	2.72	2.18	5.29	2.82	33 86	30 00	746

747	Pure Animal Bone Phosphate,	F. W. Miller, Sellersville, Pa.,	Sellersville,	"	2.56	3.71	6.80	2.98	1.40	23 21	28 00	747
749	Victor Bone Fertilizer,	New Jersey Chemical Co., Philadelphia, Pa.,	Quakertown,	"	8.59	5.80	1.46	2.55	1.92	25 27	25 00	749
750	Pure Bone Phosphate,	Jacob Trinley, Limerick Station, Pa.,	Linfield,	"	4.92	5.28	4.31	2.29	8.51	83 99	35 00	750
752	Favorite Bone Phosphate,	" " "	"	"	7.20	4.09	8.09	1.18	1.99	28 48	81 00	752
754	Ravene Bone Phosphate,	" " "	"	"	7.34	2.97	2.84	0.71	0.98	22 81	25 00	754
755	Soluble Bone Phosphate,	Lorentz & Rittler, Baltimore, Md.,	Cedar Springs,	Apr. 7,'87	8.37	2.47	8.87	1.39	0.24	22 65	25 00	755
757	Special Potato Fertilizer,	Williams, Clark & Co., New York,	"	"	6 45	1.18	0.43	8.81	4.45	85 19	40 00	756
758	Star Bone Phosphate,	J. E. Tygert & Co., Philadelphia, Pa.,	"	"	6.49	8.19	1.50	2.54	2.22	26 78	82 00	758
762	Planet Phosphate,	Peninsular Fertilizer Company, Smyrna, Del.,	Rosedale,	"	6.38	2.81	1.45	1.60	1.88	23 85	25 00	762
763	Ammoniated Superphosphate,	Buffalo Fertilizer Works, Buffalo, N. Y.,	Cedar Springs,	"	8.68	2.80	1.85	0.95	4.49	35 67	84 00	763
764	Q. & L. Phosphate,	Waring Fertilizer Company, Colora, Md.,	Rosedale,	"	8.25	8.63	1.27	1.62	2.45	29 98	25 00	764
766	Ceres Phosphate,	Ceres Manufacturing Company, Baltimore, Md.,	Cedar Springs,	"	0.10	4.02	9.34	1.98	1.28	20 26	27 00	766
767	Ceres Bone and Potash,	" " " "	"	"	0.02	8.25	8.78	8.84	0.65	17 80	25 00	767
768	Wando Phosphate,	Wando Phosphate Company, Philadelphia, Pa.,	Media,	"	9.81	2.08	1.70	1.05	3.21	30 66	33 00	768
769	Susquehanna Bone Fertilizer,	Susquehanna Fertilizer Co., Baltimore, Md.,	Hamburg,	Apr. 9,'87	4.98	8.56	4.23	0.88	1.41	22 66	34 00	769
770	Normal Bone Phosphate,	I. P. Thomas & Son, Philadelphia, Pa.,	Philadelphia,	"	6.81	8.24	1.44	2.01	1.91	25 73	25 00	770
771	Potato Manure,	" " " "	"	"	4.14	5.65	1.80	8.32	2.81	33 27	38 00	771
772	Farmer's Choice Bone Phosphate,	" " " "	"	"	8.36	2.64	1.61	1.45	2.04	27 28	30 00	772
773	Tip-Top Raw Bone Phosphate,	" " " "	"	"	7.17	4.61	0.50	2.49	4.26	36 54	87 00	773
774	Newport's All Crop Fertilizer,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	"	7.07	2.46	1.85	1.56	4.76	34 47	25 00	774
775	Ammoniated Bone Phosphate	Jacob Ulmer, Pottsville, Pa.,	Pottsville,	"	7.00	2.47	3.07	1.69	3.69	31 85	35 00	775
777	Soluble Alkaline Bone,	Susquehanna Fertilizer Co., Baltimore, Md.,	Hamburg,	"	6.56	4.49	1.82	2.30	...	20 71	28 00	777
781	Mapes Corn Manure,	Mapes Fertilizer Company, New York,	West Fairview,	Apr. 14,'87	7.50	8.11	8.08	6.09	4.56	41 02	43 00	781
782	Imperial Phosphate,	Eureka Fertilizer Company, Perrysville, Md.,	Greene,	Apr. 20,'87	6.84	8.69	0.86	1.81	1.20	23 43	20 00	782
784	Farmer's Favorite Phosphate,	" " " " "	"	"	8 32	8.47	1.23	1.92	2.72	31 01	29 00	784
786	Reading Bone Phosphate,	John F. Orth, Reading, Pa.,	Reading,	"	0.35	8.19	1.02	0.65	0.90	10 19	25 00	786
787	Star Bone Phosphate,	J. E. Tygert & Co., Philadelphia, Pa.,	West Fairview,	"	6.94	2.73	1.61	2.69	2.20	26 93	30 00	787
790	Soluble Bone Phosphate,	Lorentz & Rittler, Baltimore, Md.,	Glenville,	Apr. 21,'87	10.16	2.14	0.77	0.65	0.27	21 76	20 00	790
791	Bone Phosphate for Corn and Oats,	" " " "	"	"	7.40	2.00	1.22	1.95	2.23	25 55	30 00	791
792	Powhattan Phosphate,	" " " "	"	"	7.29	1.64	2.51	2.88	2.47	27 58	80 00	792
793	Complete Bone Phosphate,	Allentown Manufacturing Co., Allentown, Pa.,	Rutherford,	"	7.29	8.02	1.71	1.91	2.36	27 80	35 00	793
794	Complete Bone Manure,	" " " "	"	"	3.08	5.67	5.76	2.14	2.46	29 11	32 00	794
795	Bay State Phosphate,	Clark's Cove Guano Company, New York.,	West Fairview,	Apr. 26,'87	9.06	2.98	1.83	2.17	8.84	35 95	39 00	795
797	Keystone Dissolved Bone,	D. D. Hess & Son, Reading, Pa.,	Lapps,	"	11.14	8.06	0.90	0.19	0.09	23 27	28 00	797
799	Standard Phosphate,	D. Scott & Bro., Elkton, Md.,	Peach Bottom,	"	4.98	8.41	2.79	2.06	1.84	22 19	....	799
805	Ammoniated Bone Phosphate,	C. H. Dempwolf & Co., York, Pa.,	York,	May 7,'87	8.79	4.57	8.77	4.98	2.90	31 24	30 00	805
807	Dissolved Bone,	" " " "	"	"	3.22	9.18	7.91	...	4.76	42 37	36 00	807
808	Corn Phosphate,	" " " "	"	"	4.30	1.53	2.69	8.20	0.72	17 13	20 00	808
809	Potato Phosphate,	" " " "	"	"	2.77	1.94	2.27	3.65	2.08	20 08	20 00	809
811	Rock and Potash,	" " " "	"	"	5.46	2.17	5.33	2.50	0.62	18 95	20 00	811
813	Special Corn and Oats Fertilizer,	P. S. Chappell & Son, Baltimore, Md.,	"	"	5.05	8.91	2.40	2.08	0.22	19 09	22 00	813
814	Soluble Flour of Bone,	" " " "	"	"	5.52	2.31	1.92	1.82	2.19	23 31	28 50	814
815	Special Tobacco Fertilizer,	" " " "	"	"	5.74	2.68	2.12	2.60	2.52	26 34	30 00	815
816	Ammoniated Phosphate,	" " " "	"	"	5.94	8.26	2.44	1.52	2.59	27 00	31 00	816
817	Orchilla Guano,	Orchilla Guano Co., Baltimore, Md.,	"	"	....	5.21	12.81	0.26	0.33	19 97	22 23	817
818	Diamond Soluble Bone,	Walton, Whann & Co., Wilmington, Del.,	"	"	7.00	7.31	2.19	...	0.50	25 48	23 00	818
819	Reliance Ammoniated Phosphate,	" " " "	"	"	5.25	4.75	2.72	1.84	2.15	27 33	27 00	819
820	Ammoniated Bone Phosphate,	E. K. Bollinger & Co., Seitzland, Pa.,	"	"	4.51	4.68	1.94	1.23	2.88	25 62	28 00	820
821	Americus Ammoniated Phosphate,	Williams, Clark & Co., New York,	"	"	8.99	1.88	0.26	2.19	8.48	81 62	85 00	821
822	Royal Bone Phosphate,	" " "	"	"	5.31	3.48	1.06	2.48	1.75	23 34	30 00	822
823	Universal Ammoniated Phosphate,	" " "	"	"	6.24	3.76	0.90	2.89	2.44	27 41	34 00	823
824	Potato Fertilizer,	" " "	"	"	5.34	1.93	0.27	8.13	4.18	34 91	43 00	224
826	Zell's Economizer,	Zell Guano Company, Baltimore, Md.,	Littlestown,	"	6.30	5.13	1.80	0.96	1.90	27 15	80 00	826

TABULATED ANALYSES OF COMMERCIAL FERTILIZERS—Continued.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Potash.	Ammonia.	Comparative Commercial Value per ton.	Selling Price at Point of Selection.	Sample Number.
827	Corn and Potato Grower,	Slingluff & Co., Baltimore, Md.,	Hanover,	May 7, '87	7.69	3.37	1.82	1.27	1.05	$24 00	$25 00	827
829	Whitelock's Vegetator,	Miller, Lippincott & Co., Baltimore, Md.,	"	"	7.04	4.20	3.27	1.07	2.74	30 99	30 00	829
830	Harvest Queen Phosphate,	Lister Chemical Works, Newark, N. J.,	"	"	7.45	3.39	0.75	1.89	1.71	25 61	26 00	830
831	Ammoniated Dissolved Bone,	" " "	"	"	8.83	2.69	1.04	1.48	2.79	30 23	30 00	831
833	Alkaline Bone,	Maryland Fertilizing Co., Baltimore, Md.,	"	"	8.24	3.28	1.76	4.05	. . .	23 18	28 00	833
831	King Philip Guano,	Clark's Cove Guano Company, New York,	"	"	5.19	3.61	3.79	8.31	2.34	28 38	28 00	834
836	Economical Ammoniated Bone,	Joshua Walker, Baltimore, Md.,	"	May 14, '87	2.82	5.54	0.95	1.27	1.79	21 50	26 00	836
837	Soluble Bone,	J. Richmond, Philadelphia, Pa.,	"	"	3.82	4.70	2.10	1.18	0.38	16 85	20 00	837
838	Cereal Bone Phosphate,	" " "	"	"	3.72	4.53	2.62	1.55	1.56	22 15	26 00	838
839	Pen-Mar Phosphate,	Wm. Davison & Co., Baltimore, Md.,	"	"	4.71	4.32	4.20	2.36	1.49	25 24	27 00	839
842	Azotized Bone Phosphate,	J. Richmond, Philadelphia, Pa.,	"	"	5.87	4.55	2.09	1.89	1.83	26 52	30 00	842
843	Linden Phosphate,	Maryland Fertilizing Co., Baltimore, Md.,	"	"	6.32	3.18	1.30	3.80	. . .	20 02	20 00	843
844	York Ammoniated Phosphate,	A. R. Brodbeck, Hanover, Pa.,	"	"	4.86	3.64	4.73	2.66	1.47	25 04	27 00	844
846	High-Grade Phosphate,	D. Blocher & Co., Baltimore, Md.,	Gettysburg,	"	7.23	9.28	1.91	1.98	1.91	36 44	31 00	846
847	Imperial Potash Manure,	P. S. Chappell & Co., Baltimore, Md.,	"	"	5.57	2.54	3.09	2.51	. . .	16 73	24 00	847
848	Hill & Drill Phosphate,	Bowker Fertilizer Company, Boston, Mass.,	"	"	6.91	3.49	3.08	1.17	2.37	28 33	35 00	848
849	Blood and Bone Mixture,	D. Blocher & Co., Baltimore, Md.,	"	"	8.71	2.86	2.43	2.49	3.10	33 48	34 00	849
858	Raw Bone Phosphate,	Allegheny City Fert. W'ks, Allegheny City, Pa.,	Pittsburgh,	May 25, '87	5.23	3.02	1.73	1.81	5.82	36 18	35 00	858
859	Mapes' Potato Manure,	Mapes Formula Company, New York,	"	"	6.48	4.89	2.63	6.73	4.30	41 36	44 00	859
860	Azotized Bone,	Allegheny City Fert. W'ks, Allegheny City, Pa.,	"	"	0.35	7.96	6.58	0.45	7.02	42 68	35 00	860
861	Garden City Phosphate,	N. W. Fertilizing Company, Chicago, Ill.,	"	"	6.39	3.81	4.87	0.37	2.83	30 21	33 00	861
862	Forest City Phosphate,	Cleveland Dryer Company, Cleveland, Ohio,	"	"	7.58	2.43	2.60	0.27	3.18	20 18	35 00	862
866	Prairie Phosphate,	N. W. Fertilizing Company, Chicago, Ill.,	"	"	7.58	3.00	3.93	0.25	2.88	30 11	29 00	866
867	Big Bonanza Phosphate,	Walker, Stratman & Co., Pittsburgh, Pa.,	"	"	7.11	4.17	2.46	0.39	3.29	31 60	33 00	867
868	Square Bone,	Cleveland Dryer Company, Cleveland, Ohio,	"	"	2.84	6.27	5.52	0.57	2.65	28 58	35 00	868
871	Imperial Bone Phosphate,	Somerset Fertilizer Company, Somerset, Pa.,	Somerset,	May 28, '87	5.55	3.29	3.70	1.25	1.44	23 25	31 00	871
875	Excelsior Bone,	" " " " "	"	"	4.09	3.19	3.90	1.61	0.63	18 52	29 00	875
876	Dissolved Bone,	" " " " "	"	"	6.72	4.52	3.98	0.48	2.91	31 59	35 00	876
877	Keystone Phosphate,	D. D. Hess & Son, Reading, Pa.,	Chalfonte,	"	12.72	2.48	1.17	1.60	. . .	26 39	25 00	877
879	Lake Erie Fish Guano,	Jarecki Chemical Company, Erie, Pa.,	Erie,	June 10, '87	5.23	4.50	3.67	2.15	2.38	28 75	28 00	879
880	Superphosphate,	" " " "	"	"	6.22	4.37	3.81	1.58	1.99	28 36	28 00	880
882	Horse-Shoe Amm. Phosphate,	N. W. Fertilizing Company, Chicago, Ill.,	Relay,	June 14, '87	6.72	3.01	4.09	0.21	2.93	20 01	33 00	882
883	Standard Fertilizer,	Church & Co., Tiverton, R. I.,	Light Street,	June 17, '87	7.13	2.17	1.16	3.41	4.17	33 40	33 00	883
884	Fish and Potash,	" " " "	"	"	2.70	2.45	0.73	8.98	4.70	38 09	28 00	884
885	Soluble Pacific Phosphate,	Glidden & Curtis, Boston, Mass.,	Bloomsburg,	June 28, '87	6.49	2.98	3.07	2.21	3.58	31 75	34 00	885

887	Good Crop Phosphate,	West Branch Fertilizer Co., Williamsport, Pa.,	"	"	8.81	8.96	2.73	2.89	2.35	24 19	33 00	887
888	Economy Bone,	" " " " " "	"	"	2.56	4.22	3.20	2.19	2.61	24 47	28 00	888
891	Ammoniated Phosphate,	D. D. Hess & Son, Reading, Pa.,	Reading,	"	2.59	4.21	1.23	2.50	2.65	23 87	35 00	891
894	Climax Phosphate,	Hubbard & Bro., Easton, Md.,	Danville,	"	5.05	4.14	0.97	1.66	1.28	21 49	30 00	894
896	Special Bone Fertilizer,	E. M. Weaver, Riverside, Pa.,	"	"	0.04	12.20	4.16	2.36	3.26	36 35	25 00	896
897	Standard Bone Phosphate,	Hubbard & Bro., Easton, Md,	"	"	5 95	4.42	1.58	2.49	2.55	27 01	35 00	897
900	Tobacco Phosphate,	Williams, Clark & Co., New York.,	Barneston,	"	8.33	9.87	0.20	4.85	8.42	45 76	43 00	900
901	Ralston's Bone Meal,	N. W. Fertilizing Company, Chicago, Ill.,	Some0set,	June 30, '87	6.33	4.48	3.36	0.36	3.68	32 86	20 00	901
903	Tobacco Phosphate,	Williams, Clark & Co., New York,	Barneston,	July 19, '87	7.33	2.94	0.42	5.05	3.24	32 84	43 00	903
904	Improved Blood Guano,	Dambman, Bros. & Co., Baltimore, Md.,	Lititz,	July 30, '87	6.09	2.82	2.32	1.83	1.99	24 72	33 00	904
905	Guarantee Guano,	F. Phillips, Philadelphia, Pa.,	Ephrata,	"	5.84	3.72	2.59	0.89	1.67	23 94	28 00	905
906	Wheat, Corn and Oats Fertilizer,	Dambman, Bros. & Co., Baltimore, Md.,	Philadelphia,	"	7.68	1.15	1.40	2.81	2.80	27 08	35 00	906
907	Special Potato Fertilizer,	" " " " "	"	"	6.81	0.97	0.52	9.99	3.87	33.52	40 00	907
908	Arlington for Truck,	" " " " "	"	"	7.45	2.46	0.93	2.21	3.80	31 73	40 00	908
909	Ammoniated Phosphate,	J. G. Downward, Coatesville, Pa.,	Rosedale,	"	7.11	2.87	1.07	1.54	1.05	22.94	35 00	909
1	Ammoniated Phosphate,	" " " "	"	Aug. 24, '87	7.11	2.87	1.07	1.54	1.05	22 94	35 00	1
2	Q. and L. Phosphate,	Waring Fertilizer Company, Colora, Md.,	Dillsburg,	Sept. 1, '87	9.76	1.87	2.99	2.25	2.74	31 77	30 00	2
7	Bone Phosphate,	Lister Agricult'l Chemical Works, Newark, N.J.,	"	"	8.72	3.53	1.95	1.33	2.82	32 08	31 00	7
8	Harvest Queen Phosphate,	" " " "	"	"	8.52	4.11	1.19	1.24	1.69	28 15	28 00	8
9	Twenty-five Dollar Phosphate,	Baugh & Son's Company, Philadelphia, Pa.,	"	"	6.70	1.90	3.19	0.15	2.99	26 63	26 00	9
11	Cereal Bone Phosphate,	J. Richmond, Philadelphia, Pa.,	"	"	3.88	8.81	1.88	1.16	1.25	19 21	24 00	11
12	Soluble Bone Phosphate,	" " "	"	"	4.40	4.38	2.89	0.74	0.33	18 22	19 00	12
16	Onondaga Chief Phosphate,	Farmers' Fertilizer Company, Syracuse, N. Y.,	Danville,	"	6.08	1.98	0.69	3.25	0.97	19 92	28 00	16
17	Standard Phosphate,	" " "	"	"	8.00	3.03	0.30	1.68	2.21	27 08	32 00	17
18	Reaper Phosphate,	" " "	"	"	7.55	2.21	0.27	3.93	2.62	28 68	32 00	18
19	Ammoniated Bone Phosphate,	Fry Brothers, McCall's Ferry, Pa.,	McCall's Ferry,	"	10.31	3.23	2.37	0.84	1.77	30 42	27 00	19
21	Ammoniated Phosphate,	Lister Agricult'l Chemical Works, Newark, N.J.,	" "	"	8.87	3.12	0.98	1.20	2.65	29 17	29 00	21
23	Dissolved Bone Phosphate,	Waring Fertilizer Company, Colora, Md.,	Dillsburg,	"	11.67	3.81	2.17	0.17	2.47	35 08	30 00	23
24	York (B) Phosphate,	A. R. Brodbeck, Baltimore, Md.,	"	Sep. 10, '87	5.23	6.08	3.91	2.90	2.24	31 75	30 00	24
26	Old Virginia Compound,	Ramsburg Fertilizer Company, Frederick, Md.,	"	"	7.20	3.99	1.55	1.43	2.00	27 37	27 00	26
28	Excelsior Plant Food,	" " "	"	"	9.42	2.49	0.50	0.64	2.87	28 16	31 00	28
29	Bone Phosphate,	Susquehanna Fertilizer Comp'y, Baltimore, Md.,	"	"	4.62	3.62	5.83	1.35	1.70	24 97	32 00	29
31	Star Bone Phosphate,	J. E. Tygert & Co., Philadelphia, Pa.,	"	"	6.96	2.71	2.00	2.38	1.61	21 92	30 00	31
33	High-Grade Phosphate,	D. Blocher & Co., Baltimore, Md.,	Manada Hill,	"	6.88	4.54	2.72	0.98	1.48	25 66	30 00	33
34	Excelsior Fertilizer,	Carey Brothers, Lumberville, Pa.,	Lumberville,	Sep. 17, '87	. . .	0.41	0.05	0.50	0.28	2 15	35 00	34
35	Dissolved Bone and Potash,	J. Taylor & Co., Trenton, N. J.,	Plumstead,	"	7.05	3.38	1.26	1.68	1.70	25 16	25 00	35
36	Union County Fertilizer,	T. Glaser, Linden, N. J.,	Lahaska,	"	8.31	2.16	2.46	0.21	2.62	19 87	26 00	36
37	Complete Fertilizer,	John Taylor & Co., Trenton, N. J.,	Morrisville,	"	8.32	8.67	3.51	2.83	2.88	34 61	31 00	37
38	Standard Fertilizer,	The J. J. Smith Co., Trenton, N. J.,	"	"	7.79	0.30	0.69	5.12	3.09	29 12	33 00	38
40	Ammoniated Phosphate,	Wando Phosphate Company, Charleston, S. C.,	Bristol,	"	4.22	6.56	2.83	0.92	3.10	30 97	30 00	40
41	No. 1 Bone Phosphate,	Sharpless & Carpenter, Philadelphia, Pa.,	"	"	7.87	2.69	2.65	2.57	1.65	22 40	25 00	41
42	Farmers' Favorite Phosphate,	T. B. Simons, Andalusia, Pa.,	"	"	3.74	4.00	3.39	3.76	3.01	29 08	. . . .	42
43	Ammoniated Bone Phosphate,	J. Ulmer, Pottsville, Pa.,	Hamburg,	"	7.08	2.50	3.26	1.38	3.60	31 56	35 00	43
44	Echo Phosphate,	M. L. Shoemaker Company, Philadelphia, Pa.,	"	"	7.08	3.41	4.07	1.59	1.67	27 31	28 00	44
46	Big Bonanza Phosphate,	Walker, Stratman & Co., Pittsburgh, Pa.,	Pittsburgh,	"	5.76	3.85	3.05	0.59	2 99	28 58	33 00	46
47	Success Phosphate,	Lister Agricult'l Chemical Works, Newark, N.J.,	"	"	8.97	3.59	1.00	1.32	2.74	31 54	32 00	47
48	Garden City Phosphate,	N. W. Fertilizing Company, Chicago, Ill.,	"	"	5.87	3.32	3.19	0.29	2.80	27 45	34 00	48
49	Prairie Phosphate,	" " "	"	"	4.93	3.92	4.86	0.15	2.37	26 28	30 00	49
50	National Bone,	" " "	"	"	5.76	2.93	3.33	0.28	2.84	26 50	34 00	50
51	Ammoniated Dissolved Bone,	Bowker Fertilizer Company, Boston, Mass.,	"	"	7.82	2.87	1.18	0.58	1.79	24 71	32 00	51
52	Hill and Drill Phosphate,	" " "	"	"	6.57	2.92	3.56	2.04	2.70	29 25	35 00	52
54	Ammoniated Bone Phosphate,	Buffalo Fertilizer Works, Buffalo, N. Y.,	"	"	7.89	2.79	1.34	0.99	3.82	32 14	35 00	54
56	Azotized Bone,	Allegheny City Fertilizer Works, Alleghyny, Pa.,	Allegheny,	Sep. 24, '87	0.52	9.07	5.55	0.41	7.17	44 59	35 00	56

TABULATED ANALYSES OF COMMERCIAL FERTILIZERS—Continued.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid	Potash.	Ammonia.	Comparative Commercial Value per ton.	Selling Price at Point of Selection	Sample Number
58	Raw Bone Phosphate,	Allegheny City Fertilizer Works, Allegheny, Pa.,	Allegheny,	Sep. 24, '87	3.63	6.19	0.64	1.80	5.70	$37 40	$35 00	58
59	Keystone Bone Phosphate,	D. D. Hess & Son, Reading, Pa.,	Dillsburg,	"	7.02	4.91	3.23	0.44	...	20 83	25 00	59
60	Ammoniated Phosphate,	" "	"	"	6.96	3.46	2.12	1.17	2.02	26 41	32 00	60
61	Reliable Bone Phosphate,	J. A. Klinefelter, Glenville, Pa.,	"	"	3.88	2.27	2.56	2.50	1.88	20 78	26 00	61
62	Jay-Eye-See Phosphate,	A. R. Brodbeck, Baltimore, Md.,	Franklintown,	"	7.80	3.52	1.73	2.26	3.20	32 63	35 00	62
67	Ammoniated Phosphate,	Bowen & Co., Baltimore, Md.,	Table Rock,	"	9.66	2.19	1.45	2.07	2.87	31 95	25 75	67
68	Twenty-six Dollar Phosphate,	F. Mehring, York Road, Md.,	Biglersville,	"	5.60	4.57	3.83	0.95	1.50	25 38	24 00	68
69	No. 2 Ammoniated Phosphate,	" " "	"	"	5.57	4.70	4.19	0.55	1.74	26 25	26 00	69
70	Dissolved Raw Bone,		"	Oct. 1, '87	10.26	8.07	0 24	...	2.22	37 07	33 00	70
71	Patent Phosphate,	Bradley Fertilizer Company, Boston, Mass.,	"	"	8.75	2.84	2.58	0.41	2.73	30 29	30 00	71
73	Dissolved Bone and Potash,	" " "	"	"	4.35	6.07	2.12	1.79	1.48	25 19	28 00	73
74	Climax Phosphate,	Hubbard & Brother, Easton, Md.,	"	"	5.83	5.28	1.58	1.12	1.54	25 40	28 00	74
75	Ammoniated Bone Phosphate,	Joshua Walker, Baltimore, Md.,	"	"	3.64	4.18	2.62	1.49	2.60	21 93	34 00	75
77	Dissolved Bone Meal,	Thompson & Edwards, Chicago, Ill.,	"	"	5.99	4.89	4.32	0.20	1.86	27 22	28 00	77
78	Bone Phosphate,	J. Richmond, Philadelphia, Pa.,	Gettysburg,	"	7.70	3.46	1.63	1.12	2.67	29 86	35 00	78
79	Ammoniated Bone Phosphate,	D. Blocher & Co., Baltimore, Md.,	"	"	4.46	3.06	2.00	1.38	0.53	17 01	23 00	79
80	Dissolved Bone and Potash,	" " "	"	"	8.64	3.68	2.52	1.26	1.89	29 42	32 00	80
81	Blood and Bone Mixture,	" " "	"	"	8.23	5.29	1.75	1.56	2.82	34 17	32 00	81
82	No. 1 Dissolved Bone,	" " "	"	"	8.46	4.20	1.84	1.01	0.24	23 56	24 00	82
83	Dissolved Slaughter-House Bone,	Joshua Horner, Jr., & Co., Baltimore, Md.,	"	"	6.26	7.83	2.39	...	2.36	32 63	32 00	83
84	Ammoniated Bone Phosphate,	" " "	"	"	3.79	4.51	1.70	2.81	2.54	26 09	28 00	84
86	Diehl's Mixture,	Adam Diehl, Fountain Run, Md.,	"	"	4.31	4.47	3.24	3.10	2.41	$28 01	$26 00	86
88	Chester County Phosphate,	United States Chemical Company, Phila., Pa.,	Saltzburg,	"	6.74	5.16	3.42	2.28	2.67	33 14	28 00	88
89	Victor Bone Phosphate,	New Jersey Chemical Company, Phila., Pa.,	"	"	1.25	6.59	0.48	2.00	1.82	21 11	25 00	69
90	Homestead Fertilizer,	Michigan Carbon Works, Detroit, Mich.,	Freeport,	Oct. 15, '87	8.30	2.92	0.68	1.15	3.25	50 85	30 00	90
95	Ammoniated Bone,	Symington Brothers & Co., Baltimore, Md.,	Saltzburg,	"	7.87	1.99	2.16	1.53	2.15	26 35	30 00	95
96	Bone and Potash,	" " "	"	"	7.80	3.84	0.72	1.23	...	20 14	22 00	96
97	Universal Dissolved Bone,	Williams, Clark & Co., New York,	"	"	6.95	2.63	0.58	2.11	2.48	26 83	33 00	97
98	Royal Bone Phosphate,	" " "	"	"	3.41	5.21	0.95	1.92	1.70	22 17	30 00	98
99	Nobesque Guano,	Pacific Guano Company, Boston, Mass.,	"	"	7.31	4.64	1.45	2.02	2.17	29 68	31 00	99
101	Pacific Guano,	" " "	"	Oct. 22, '87	6.91	2.94	3.10	2.46	3.78	33 55	36 00	101
103	Crocker's Ammoniated Phosphate,	Crocker Fertilizer Company, Buffalo, N. Y.,	Greensburg,	"	8.70	3.24	0.98	1.71	3.68	31 18	34 00	103
104	D. B. Sea Fowl Guano,	Bradley Fertilizer Company, Boston, Mass.,	"	"	8 65	2.66	2.66	1.00	2.87	29 99	36 00	104
108	Bone and Meat Phosphate,	Vaughn, Bonsall & Co., Salem, Ohio,	"	"	3.56	3.05	3.21	0 84	3.01	23 72	33 00	108
109	Wheat Growers' Jewel,	Parks Guano Company, Baltimore, Md.,	Gettysburg,	"	3.17	3.38	1.09	1.92	1.12	25 00	26 00	109

111	Farmers' Standard Phosphate,	G. Ober's Sons & Co., Baltimore Md.,	Gettysburg,	Oct. 22, '87	7.80	4.82	1.66	1.88	2.15	29 11	28 00	111
112	Standard Bone Phosphate,	Hubbard & Brother, Easton, Md.,	"	"	6.77	4.48	2.05	1.65	2.51	29 93	30 00	112
113	Baker's Standard Guano,	Chemical Company of Canton, Baltimore, Md.,	Mechanicsburg,	"	5.93	3.39	3.84	1.85	2.40	27 59	30 00	113
114	Horse-Shoe Ammoniated Bone,	N. W. Fertilizing Company, Chicago, Ill.,	"	"	5.71	3.92	5.97	0.24	3.02	30 70	32 50	114
115	Orchilla Guano,	Orchilla Guano Company, Baltimore, Md.,	"	"	0.06	4.98	12.79	0.17	0.29	19 45	23 00	115
117	Farmers' Choice Bone Phosphate,	I. P. Thomas & Son, Philadelphia, Pa.,	Phillipsburg,	"	8.05	3.74	1.39	1.98	2.81	29 80	32 00	117
119	Soluble Bone and Potash,	New Jersey Chemical Company, Phila., Pa.,	Wilkinsburg,	"	8.51	6.19	0.86	2.01	. . .	25 87	24 00	119
120	Forest City Phosphate,	Cleveland Dryer Company, Cleveland, Ohio,	Pittsburgh,	Oct. 29, '87	7.37	4.20	2.48	0.19	2.77	30 06	33 00	120
121	Sure Crop Bone Phosphate,	Bowker Fertilizer Company, Boston, Mass.,	Beaver,	"	8.99	3.14	0.61	1.06	1.81	25 51	30 00	121
123	Calvert Guano,	Zell Guano Company, Baltimore, Md.,	New Castle,	"	7.85	4.67	1.70	0.90	0.72	24 74	35 00	123
124	Horse Flesh,	Collins & Hardy, Mansfield, Pa.,	Mansfield,	"	. . . .	. . .	4.60	. . .	12.81	46 45	25 00	124
127	Diamond Soluble Bone,	The Walton & Whann Co., Wilmington, Del.,	Mercer,	"	7.09	7.56	3.03	. . .	0.50	26 35	20 00	127
128	Soluble Bone Phosphate,	Lorentz & Rittler, Baltimore, Md.,	"	"	10.31	4.75	1.57	0.16	0.16	25 43	26 00	128
129	Jarves Drill Phosphate,	Michigan Carbon Works, Detroit, Mich.,	Greenville,	"	6.10	2.38	2.42	0.17	1.36	20 30	27 00	129
130	Queen City Phosphate,	Crocker Fertilizer Company, Buffalo, N. Y.,	"	Nov. 5, '87	8.09	3.09	0.49	1.92	2.35	28 19	30 00	130
131	Square Bone,	Cleveland Dryer Company, Cleveland, Ohio,	"	"	3.38	7.23	4.95	0.67	2.82	31 20	30 00	131
132	Buckeye Bone Phosphate,	" " "	"	"	8.22	3.16	2.77	0.84	2.71	29 98	30 00	132
135	XXV Phosphate,	E. Frank Coe, New York,	Union City,	"	6.38	4.24	2.66	1.28	1.47	25 40	30 00	135
137	Ohio Seed-Maker,	Cleveland Dryer Company, Cleveland, Ohio,	Meadville,	"	9.10	4.12	0.54	0.35	1.21	26 01	26 00	137
138	Erie City Fertilizer,	Schaal Brothers, Erie, Pa.,	Erie,	"	4.08	4.54	1.87	1.98	2.59	25 28	29 00	138
141	Lake Erie Fish Guano,	Jarecki Chemical Company, Erie, Pa.,	"	"	4.67	3.24	3.40	2.57	1.48	22 98	28 00	141
142	Superior Phosphate,	" "	"	"	3.98	3.33	3.51	2.70	1.48	22 24	28 00	142
143	Game Guano,	Baltimore Guano Company, Baltimore, Md.,	Gettysburg,	"	5.80	4.77	2.48	2.33	2.86	30 94	30 00	143
145	Zell's Economizer,	Zell Guano Company, Baltimore, Md.,	"	"	6.90	3.77	2.80	0.86	1.71	25 58	28 00	145
146	Farmers' Gold Dust Phosphate,	J. A. Livers, Gettysburg, Pa.,	"	"	4.22	3.12	2.32	1.04	1.00	26 04	28 00	146
147	Dissolved Animal Bone,	Chemical Company of Canton, Baltimore, Md.,	"	"	2.93	14.81	3.56	. . .	3.10	40 97	33 00	147
148	Columbia Guano,	Hubbard & Brother, Easton, Md.,	Hanover,	"	6.29	4.61	1.74	1.01	0.61	21 91	24 00	148
150	Old Pittsburgh Phosphate,	Joshua Walker, Baltimore, Md.,	"	Nov. 12, '87	5.02	4.48	2.76	1.29	2.12	25 73	30 00	150
152	Pen-Mar Phosphate,	William Davidson, Baltimore, Md.,	"	"	5.07	3.34	3.95	3.00	1.61	25 09	27 00	152
153	Alkaline Bone,	Maryland Fertilizer Company, Baltimore, Md.,	"	"	7.89	4.70	1.79	3.93	. . .	24 79	25 00	153
155	No. 2 Bone Compound,	W. & H. Goulding, Baltimore, Md.,	"	"	7.04	2.21	0.22	2.07	1.22	21 20	26 00	155
158	Harvest Queen Phosphate,	Lister Agricult'l Chemical Works, Newark, N.J.,	"	"	9.22	2.77	0.42	1.63	2.04	28 09	26 00	158
159	Gem Guano,	Chesapeake Guano Company, Baltimore, Md.,	"	"	2.77	9.17	2.85	0.54	1.89	26 34	25 00	159
160	Double Eagle Phosphate,	Baugh & Sons' Company, Philadelphia, Pa.,	"	Nov. 18, '87	7.05	2.24	3.50	0.25	2.95	27 94	25 00	160
161	Ammoniated Bone Phosphate,	E. K. Bollinger & Co., Seitzland, Pa.,	York,	"	6.11	3.59	2.12	1.22	1.69	24 19	28 00	161
162	Swift Sure Phosphate,	M. L. Shoemaker Company, Philadelphia, Pa.,	"	"	8.96	3.37	3.99	3.90	3.76	39 60	35 50	162
163	Soluble Ammoniated Phosphate,	G. Ober's Sons & Co., Baltimore, Md.,	"	"	7.87	3.28	3.06	1.39	2.96	30 94	30 00	163
164	Americus Phosphate,	Williams, Clark & Co., New York,	Franklin,	"	10.38	2.52	0.48	2.63	3.77	36 49	38 00	164
165	Chesapeake Guano,	Chesapeake Guano Company, Baltimore, Md.,	Kittanning,	"	4.99	6.69	3.12	0.69	2.55	30 55	28 00	165
167	Planet Brand Phosphate,	Peninsular Fertilizer Company, Smyrna, Del.,	West Chester,	"	5.79	2.66	2.58	2.16	1.83	23 96	25 00	167
172	Soluble Bone,	J. Richmond, Philadelphia, Pa.,	"	"	4.48	6.61	2.80	1.29	. . .	20 15	17 00	172
174	Twenty-three Dollar Phosphate,	M. L. Shoemaker Company, Philadelphia, Pa.,	Media,	"	7.20	3.70	4.89	1.45	1.76	28 78	23 00	174
178	Pure Bone Phosphate,	H. Cope & Co., Lincoln University, Pa.,	"	"	8.97	5.90	2.72	2.19	2.94	30 16	. . . .	178
179	Chester Bone Phosphate,	W. P. Eyre, Chester, Pa.,	Chester,	"	3.28	3.71	2.17	3.63	1.60	21 99	30 00	179
180	Complete Manure ("A"),	Mapes Formula Company, New York,	Abington,	"	4.77	6.62	4.47	3.85	3.53	37 15	38 00	180
181	Complete Manure for General Use,	" " "	"	"	3.84	5.88	3.51	3.92	4.74	38 40	41 00	181
185	Farmers' New Method Phosphate,	Bradley Fertilizer Company, Boston, Mass.,	Pottsgrove,	Oct. 29, '87	7.22	2.62	1.54	1.95	1.32	23 41	30 00	185
186	Soluble Sea Island Guano,	Rasin Fertilizer Company, Baltimore, Md.,	"	"	2.85	5.65	2.42	1.68	2.57	25 96	30 00	186
187	Dissolved Bone,	" " "	"	"	5.79	4.27	1.63	0.18	2.32	25 51	28 00	187
188	Improved Phosphate,	F. Phillips, Philadelphia, Pa.,	"	"	6.56	3.26	2.33	1.72	2.41	27 48	32 00	188
191	Special Bone Phosphate,	E. M. Weaver, Riverside, Pa.,	"	"	0.05	5.87	4.83	2.82	2.66	25 19	25 00	191
194	AA Phosphate,	W. Kenderdine, Lumberville, Pa.,	New Hope,	"	6.64	3.36	0.92	4.36	2.46	29 46	28 00	194
196	Ammoniated Bone and Potash,	C. H. Dempwolf & Co., York, Pa.,	Goldsboro',	"	5.15	3.83	3.97	1.89	1.21	23 55	20 00	196

TABULATED ANALYSES OF COMMERCIAL FERTILIZERS—Continued.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Potash.	Ammonia.	Comparative Commercial Value per ton.	Selling Price at Point of Selection.	Sample Number.
197	Excelsior Phosphate,	J. C. Long & Co., Baltimore, Md.,	Goldsboro',	Oct. 29, '87	5.09	3.92	2.37	1.73	3.02	$28 32	$32 00	197
198	Ammoniated Bone,	Ramsburg Fertilizer Company, Frederick, Md.,	"	"	10.49	3.91	2.33	0.21	1.28	29 51	24 00	199
200	Crocker's Amm'd Bone Phosphate,	Crocker Fertilizer Company, Buffalo, N. Y.,	Red Lion,	"	8.47	3.69	1.31	1.11	4.17	34 89	33 00	200
201	United States Phosphate,	Lister Ag'l Chemical Works, Newark, N. J.,	Lititz,	Oct. 7, '87	5.37	4.62	1.27	2.00	1.73	24 88	28 00	201
202	Rising Sun Phosphate,	Lancaster Chemical Company, Lancaster, Pa.,	"	"	6.86	6.83	2.35	2.31	3.65	36 49	31 00	202
203	Buffalo Ammoniated Phosphate,	Crocker Fertilizer Company, Buffalo, N. Y.,	"	"	8.37	2.65	0.83	0.93	4.37	34 08	35 00	203
204	Sure Growth Phosphate,	Bowker Fertilizer Company, Boston, Mass.,	"	"	9.13	2.45	0.55	0.79	1.28	24 11	30 00	204
205	Ammoniated Bone Phosphate,	J. Ulmer, Pottsville, Pa.,	"	"	7.34	2.53	2.81	2.07	4.02	33 78	35 00	205
206	Pioneer Bone Phosphate,	J. G. Downward, Coatesville, Pa.,	"	"	5.95	3.83	1.58	2.62	1.87	25 89	33 00	206
207	Patent Phosphate,	Bradley Fertilizer Company, Boston, Mass.,	"	"	7.74	2.78	2.66	0.74	3.08	30 17	35 00	207
208	Alkaline Bone,	E. Frank Coe, New York,	Bloomsburg,	Oct. 15, '87	5.01	5.50	1.97	1.07	1.61	24 91	21 00	208
209	Fish and Potash,	Church & Co., Tiverton, Rhode Island,	"	"	2.12	2.59	1.23	8.51	4.90	28 72	27 00	209
212	Diamond Soluble Bone,	The Walton & Whann Co., Wilmington, Del.,	King's Bridge,	"	4.81	9.62	1.66	. .	0.58	25 72	20 00	212
216	Reliance Ammoniated Phosphate,	" " "	"	"	4.42	4.26	3.04	1.50	3.49	29 69	. . . .	216
217	Sure Growth Phosphate,	Scott Fertilizer Company, Elkton, Md.,	Fairmount,	"	4.50	3.05	5.37	1.84	2.41	26 41	28 00	217
218	Red Bag Bone Phosphate,	W. G. Powell, Baltimore, Md.,	King's Bridge,	"	3.61	3.05	1.17	3.30	2.67	23 98	22 50	218
222	Reading Bone Phosphate,	J. F. Orth, Reading, Pa.,	Linglestown,	Nov. 10, '87	. . . .	3.22	0.82	0.34	0.82	6 51	25 00	222
226	German (A) Guano,	W. C. Newport & Co., Willow Grove, Pa.,	Willow Grove,	Nov. 30, '87	7.70	4.16	0.52	4.06	2.67	32 88	30 00	226
228	All Crop Fertilizer,	" " "	"	"	7.52	4.05	2.35	1.42	2.89	31 65	25 00	228
234	Rectified Phosphate,	" " "	"	"	6.77	4.43	3.61	4.18	3.86	38 43	36 00	234
236	Ammoniated Soluble Bone,	" " "	"	"	8.32	4.09	1.41	0.42	2.63	30 36	25 00	236
238	Pure Dissolved Bone,	Lechlider Brothers, Hagerstown, Md.,	Littlestown,	"	3.22	8.48	7.13	. . .	2.56	33 12	33 00	238
239	Raw Bone Phosphate,	Jacob Trinley, Limerick Station,	Linfield,	"	2.90	9.54	5.19	2.16	3.75	38 96	34 00	239
240	Ravene Phosphate,	" "	"	"	5.93	6.49	3.75	1.28	1.78	30 20	24 00	240
241	Favorite Bone Phosphate,	" "	"	"	5.25	8.39	3.67	1.31	2.31	33 92	30 00	241

Acidulated South Carolina Rock.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Available Phosphoric Acid *as found*.	Available Phosphoric Acid *as guaranteed*.	Comparative Commercial Value per ton.	Selling Price at Point of Selection.	Sample Number.
719	T. & P. Acid Phosphate,	Waring Fertilizer Company, Colora, Md.,	Cedar Springs,	Mch. 15, '87	10.68	5.40	1.72	16.06	13—15	$26 39	$25 00	719
722	Superior Rock Phosphate,	Susquehanna Fertilizer Co., Baltimore, Md.,	Kennett Square,	Mch. 23, '87	8.30	6.50	1.52	14.80	13—15	21 20	15 00	722
728	Cope's Acid Phosphate,	Henry Cope & Co., Lincoln University, Pa.,	L. University,	"	3.12	10.43	2.95	13.55	. . . . . .	22 86	15 00	728
731	Soluble South Carolina Rock,	Josiah Cope & Co., Lincoln University, Pa.,	"	"	10.53	4.23	2.21	14.80	12—15	21 56	15 00	731
753	Plain Phosphate,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	Apr. 2, '87	11.45	3.01	2.19	14.49	13	21 06	18 00	753
756	Zell's Dissolved Bone,	Zell Guano Company, Baltimore, Md.,	Cedar Springs,	Apr. 7, '87	8.46	7.40	4.79	15.86	12—15	27 30	26 00	756
759	Star Dissolved S. C. Rock,	J. E. Tygert & Co., Philadelphia, Pa.,	"	"	8.47	4.11	2.95	12.68	12—14	21 79	18 00	759
765	T. & P. Acid Phosphate,	Waring Fertilizer Company, Colora, Md.,	Rosedale,	"	10.31	4.79	2.21	15.10	13—15	25 01	15 00	765
776	Soluble Bone Phosphate,	Susquehanna Fertilizer Co., Baltimore, Md.,	Hamburg,	Apr. 9, '87	10.43	3.73	1.55	14.16	13—15	21 29	23 00	776
783	Dissolved South Carolina Rock,	Eureka Fertilizer Company, Perryville, Md.,	Greene,	Apr. 20, '87	10.54	4.86	0.46	15.42	. . . . . .	24 82	15 00	783
789	Dissolved South Carolina Bone,	Lorentz & Rittler, Baltimore, Md.,	Glenville,	Apr. 21, '87	9.74	2.14	1.48	11.88	12—15	19 60	20 00	789
796	Acid Phosphate,	D. D. Hess & Son, Reading, Pa.,	Lapp's,	Apr. 26, '87	11.39	4.76	1.73	16.15	12—15	26 53	18 00	796
798	Dissolved S. C. Rock,	W. S. Powell, Baltimore, Md.,	Peach Bottom,	"	11.01	1.85	0.88	12.86	12—15	20 91	17 00	798
800	Tip-Top Soluble Phosphate,	D. Scott & Bro., Elkton, Md.,	"	"	8.57	4.66	3.68	13.23	13—15	22 64	18 00	800
801	Dissolved S. C. Rock,	" " "	"	"	11.21	3.82	1.14	15.03	13—15	21 51	18 00	801
802	Dissolved S. C. Rock,	F. Phillips, Philadelphia, Pa.,	Fairmount,	"	11.51	3.78	0.93	15.32	12—15	21 88	18 00	802
803	Dissolved S. C. Rock,	Walton, Whann & Co., Wilmington, Del.,	Kings Bridge,	"	7.81	6.68	2.62	14.52	12—13	21 28	20 00	803
804	Dissolved S. C. Rock,	Susquehanna Fertilizer Co., Baltimore, Md.,	Quarryville,	"	8.59	5.96	1.21	14.55	13—15	23 76	17 00	804
806	Dissolved S. C. Rock,	C. H. Dempwolf & Co., York, Pa.,	York,	May 7, '87	9.69	4.81	0.57	14.53	. . . . . .	23 48	18 00	806
812	Dissolved S. C. Bone,	Slingluff & Co., Baltimore, Md.,	Hanover,	"	10.09	3.29	3.63	13.38	13—15	22 88	18 00	812
825	Superior Rock Phosphate,	Susquehanna Fertilizer Co., Baltimore, Md.,	Littlestown,	"	10.59	1.95	4.14	12.54	13—15	21 72	20 00	825
832	High-Grade Dissolved S. C. Bone,	Baltimore Guano Company, Baltimore, Md.,	Hanover,	"	9.00	6.20	1.48	15.20	13—16	21 91	18 00	832
835	Dissolved S. C. Bone,	Joshua Walker, Baltimore, Md.,	"	May 14, '87	8.51	4.86	2.29	13.37	13—15	23 31	20 00	835
840	Acid Phosphate,	J. Richmond & Co., Philadelphia, Pa.,	"	"	8.51	6.41	1.91	14.92	12—15	21 65	23 00	840
815	Brodbeck's Soluble Bone,	A. R. Brodbeck, Hanover, Pa.,	"	"	9.72	3.92	4.37	13.61	12—15	23 57	20 00	845
850	Bowker's Superphosphate,	Bowker Fertilizer Company, Boston, Mass.,	Gettysburg,	"	8.86	4.03	5.67	12.88	12—14	22 88	24 00	850
856	Dissolved S. C. Bone,	Sharpless & Carpenter, Philadelphia, Pa.,	Landenberg,	May 17, '87	12.31	3.98	3.36	16.29	12—14	27 40	15 00	856
873	Acid Phosphate,	Somerset Fertilizer Company, Somerset, Pa.,	Somerset,	May 28, '87	3.58	3.58	1.27	7.16	11—13	11 97	21 00	873
878	Soluble Bone,	F. Phillips, Philadelphia, Pa.,	Wolf Run,	June 3, '87	10.28	4.31	1.45	14.62	12—15	23 80	20 00	878
889	Dissolved S. C. Rock,	Sharpless & Carpenter, Philadelphia, Pa.,	Bloomsburg,	June 28, '87	8.21	5.44	4.00	13.65	12—14	23 44	17 00	889
892	Diamond State Soluble Bone,	Lord & Poke Co., Odessa, Del.,	"	"	10.41	3.65	1.85	. . . .	. . . . . .	21 23	21 00	893
865	Phosphate of Lime,	Glidden & Curtis, Boston, Mass.,	"	"	9.33	5.26	3.06	14.64	12—14	21 61	20 00	895
898	T. & P. Acid Phosphate,	Waring Fertilizer Company, Colora, Md.,	Port Royal,	"	10.39	5.49	2.98	15.88	13—15	26 60	23 00	898
8	T. & P. Acid Phosphate,	" " " " "	Dillsburg,	Sept. 1, '87	6.17	8.52	2.58	14.69	13—15	21 53	20 00	8
6	Acidulated S. C. Rock,	Baugh & Sons' Company, Philadelphia, Pa.,	"	"	9.26	4.68	2.74	13.94	12—14	23 40	20 00	6

TABULATED STATEMENT OF COMMERCIAL FERTILIZERS—Continued.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where selected.	Date of Analyses.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Available Phosphoric Acid *as found*.	Available Phosphoric Acid *as guaranteed*.	Comparative Commercial Value per ton.	Selling Price at Point of Selection.	Sample Number.
13	Acid Phosphate,	J. Richmond, Philadelphia, Pa.,	Dillsburg,	Sept. 1, '87	6.78	7.43	3.49	14.21	12—15	$24 14	$21 00	13
20	Superior Acid Phosphate,	Susquehanna Fertilizer Company, Balto., Md.,	McCall's Ferry,	Sept. 5, '87	9.03	5.45	1.82	14.48	13—15	23 90	15 00	20
22	S. C. Bone Phosphate,	G. Ober's Sons & Co., Baltimore, Md.,	Dillsburg,	Sep. 10, '87	8.76	4.99	2.88	13.75	11—14	23 15	20 00	22
25	Soluble Bone,	A. R. Brodbeck, Baltimore, Md.,	"	"	8.07	5.73	4.22	13.80	12—15	25 87	20 00	25
30	Soluble Bone Phosphate,	Susquehanna Fertilizer Company, Balto., Md.,	"	"	8.21	4.96	3.84	13.17	13—15	22 61	22 00	30
32	Diamond State Soluble Bone,	Lord & Polk Company, Odessa, Del.,	"	"	10.70	5.09	2.88	15.79	14—16	26 21	20 00	32
64	Dissolved S. C. Rock,	Lorentz & Rittler, Baltimore, Md.,	"	Sep. 13, '87	9.72	3.45	2.89	13.17	12—15	22 03	20 00	64
66	Dissolved S. C. Bone,	Bowen & Co., Baltimore, Md.,	Table Rock,	Sep. 24, '87	9.91	4.06	0.33	13.97	13—15	22 48	16 00	66
72	Palmetto Acid Phosphate,	Bradley Fertilizer Company, Boston, Mass.,	Biglersville,	Oct. 1, '87	10.47	3.60	1.61	14.07	12—14	23 15	18 00	72
76	Dissolved S. C. Phosphate,	Joshua Walker, Baltimore, Md.,	"	"	8.71	6.10	1.10	14.81	13—15	24 14	20 00	76
87	Bowker's Phosphate,	Bowker Fertilizer Company, Boston, Mass.,	Saltzburg,	"	10.57	4.82	2.08	15.39	12—14	25 44	20 00	87
100	Dissolved Bone Phosphate,	Pacific Guano Company, Boston, Mass.,	"	Oct. 22, '87	9.38	5.35	3.61	14.73	12—14	25 01	22 00	100
110	Dissolved S. C. Bone,	Dambmann Bros. & Co., Baltimore, Md.,	Gettysburg,	"	12.30	3.82	1.02	16.12	13—15	26 60	20 00	110
118	Acid Phosphate,	Rasin Fertilizer Company, Baltimore, Md.,	Beaver,	"	8.79	6.61	2.35	15.40	13—15	25 58	22 00	118
122	Bone Phosphate,	Zell Guano Company, Baltimore, Md.,	New Castle,	Oct. 29, '87	9.90	5.84	1.09	15.74	13—16	25 62	27 00	122
134	Soluble Bone,	E. Frank Coe, New York,	Union City,	Nov. 5, '87	9.22	5.26	2.32	14.48	13—15	24 10	20 00	134
144	Dissolved Bone Phosphate,	Zell Guano Company, Baltimore, Md.,	Gettysburg,	"	10.80	5.50	0.69	16.30	13—15	26 36	20 00	144
149	Soluble Bone,	Hubbard & Bro., Easton, Md.,	Hanover,	"	8.48	6.30	3.41	14.78	12—14	25 11	20 00	149
151	Dissolved S. C. Bone,	P. S. Chappell & Son, Baltimore, Md.,	"	Nov. 12, '87	7.94	4.95	1.80	12.89	11—14	21 34	16 50	151
154	Superphosphate,	W. & H. Goulding, Baltimore, Md.,	"	"	12.29	2.81	0.17	15.10	13—16	24 23	20 00	154
166	Dissolved Bone-Black,	Lister Agr'l Chemical Works, Newark, N. J.,	Kittanning,	Nov. 18, '87	12.25	2.80	0.30	15.05	. . . . .	24 32	26 00	166
169	Acid Phosphate,	Peninsular Fertilizer Company, Smyrna, Del.,	West Chester,	"	9.93	5.06	1.64	14.99	. . . . .	24 64	17 00	169
182	Concentrated Phosphate,	Keystone Chemical Company, Phila., Pa.,	Harrisburg,	Oct. 1, '87	0.03	40.47	6.88	40.50	38—42	67 55	35 00	182
183	Dissolved S. C. Rock,	W. S. Powell, Baltimore, Md.,	Greencastle,	"	11.35	4.23	1.41	15.58	12—15	25 49	17 00	183
189	Dissolved S. C. Bone,	Chemical Company of Canton, Baltimore, Md.,	Pottsgrove,	Oct. 29, '87	7.80	6.85	2.34	14.65	14—16	24 30	20 00	189
211	Soluble Bone Phosphate,	F. Phillips, Philadelphia, Pa.,	Bloomsburg,	Oct. 15, '87	5.65	8.57	1.64	14.22	13—16	23 40	19 00	211
215	T. and P. Phosphate,	Waring Fertilizer Company, Colora, Md.,	King's Bridge,	"	4.45	9.79	2.92	14.24	13—15	23 95	16 00	215
220	Dissolved S. C. Rock,	Eureka Fertilizer Company, Perryville, Md.,	Oxford,	Oct. 22, '87	11.72	3.69	0.99	15.41	12—15	25 06	16 50	220
221	Acorn Phosphate,	Williams, Clark & Co., New York,	Lemasters,	Oct. 29, '87	6.92	7.76	0.67	14.68	12—15	23 76	16 00	221
237	Plain Superphosphate,	W. C. Newport & Co., Willow Grove,	Willow Grove,	Nov. 30, '87	10.30	4.81	0.87	15.11	. . . . .	24 33	16 00	237

Ground Bone.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Phosphoric Acid.	Ammonia.	Comparative Commercial Value per ton.	Selling Price per ton at Point of Selection.	Sample Number.
723	Pure Fine Ground Bone,	J. Gawthrop & Co., Kennett Square, Pa.,	Kennett Square,	Mch. 23, '87	23.81	4.53	$38 58	$30 00	723
733	Susquehanna No. 8 Bone,	Susquehanna Fertilizer Company, Baltimore, Md.,	Fairville,	Mch. 25, '87	20.65	4.39	35 58	32 00	733
737	Pure Ground Bone,	J. G. Downward, Coatesville, Pa.,	Cedar Knoll,	"	24.13	4.58	39 70	33 00	737
742	Pure Ground Raw Bone,	Jacob Trinley, Limerick Station, Pa.,	Limerick Sta.,	Apr. 2, '87	21.03	5.10	38 37	35 00	742
744	Swift-Sure Ground Bone,	M. L. Shoemaker & Co., Philadelphia, Pa.,	Quakertown,	"	17.24	8.16	43 98	39 00	744
751	Newport's Pure Bone Dust,	W. C. Newport & Co., Willowgrove, Pa.,	Willow Grove,	"	22.87	4.77	39 09	36 00	751
760	Pure Ground Bone,	J. E. Tygert & Co., Philadelphia, Pa.,	Cedar Springs,	Apr. 7, '87	27.99	2.90	37 85	37 00	760
761	Pure Ground Bone,	Sharpless & Carpenter, Philadelphia, Pa.,	Rosedale,	"	20.82	4.50	36 12	. . . .	761
778	Carbonized Bone,	C. S. Clark, Union City, Pa.,	Union City,	"	34.97	. . . .	27 98	25 00	778
810	Pure Bone Meal,	C. H. Dempwolf & Co., York, Pa.,	York,	May 7, '87	22.49	4.86	39 01	32 00	810
828	Pure Bone Meal,	Joseph Lister, Chicago, Ills.,	Hanover,	"	24.84	4.11	38 81	36 00	828
841	Pure Bone Meal,	J. Richmond, Philadelphia, Pa.,	"	May 14, '87	22.28	4.30	36 90	36 00	841
852	Bone Meal,	Baugh & Sons, Philadelphia, Pa.,	L. University,	"	20.98	4.76	37 16	32 00	852
853	Button Bone,	Emil Wahl, Philadelphia, Pa.,	"	"	25.60	4.83	41 02	38 00	853
851	Pure Ground Bone,	W. Ewing, Landenburg, Pa.,	Landenberg,	May 17, '87	20.47	4.28	35 02	31 00	851
857	Pure Bone Meal,	Allegheny City Fertilizer Company, Allegheny City, Pa.,	Pittsburgh,	May 25, '87	22.82	4.80	39 14	35 00	857
864	Pure Bone (No. 14),	Walker, Stratman & Co., Pittsburgh, Pa.,	"	"	24.67	4.81	39 02	35 00	864
865	Pure Ground Bone,	Allegheny City Fertilizer Company, Allegheny City, Pa.,	"	"	21.49	5.22	39 24	35 00	865
869	Superior Bone Meal,	Cleveland Dryer Company, Cleveland, Ohio.,	"	"	22.54	4.37	37 40	40 00	869
870	Fine Raw Bone,	N. W. Fertilizing Company, Chicago, Ills.,	"	"	22.52	4.39	37 45	35 00	870
871	Pure Bone (No. 12),	Walker, Stratman & Co., Pittsburgh, Pa.,	"	"	23.46	4.81	39 81	35 00	871
872	Bone Meal,	Somerset Fertilizing Company, Somerset, Pa.,	Somerset,	May 28, '87	23.92	4.83	40 34	36 00	872
881	Ground Bone,	Jarecki Chemical Company, Erie, Pa.,	Erie,	June 10, '87	18.52	4.53	33 92	33 00	881
886	Fine Raw Bone,	N. W. Fertilizing Company, Chicago, Ills.,	Bloomsburg,	June 28, '87	23.28	4.82	37 97	32 00	886
902	Bone Meal,	Williams, Clark & Co., New York,	Barneston,	July 19, '87	19.03	5.87	38 99	39 90	902
5	Bone Meal,	Baugh & Sons' Company, Philadelphia, Pa.,	Dillsburg,	Sep. 1, '87	22.72	4.73	38 80	34 00	5
10	Ground Bone,	Lister Agricultural Chemical Works, Newark, N. J.,	"	"	12.72	3.39	24 25	33 00	10
27	Raw Bone,	Ramsburg Fertilizer Company, Frederick, Md.,	"	Sep. 10, '87	26.04	4.08	39 91	36 00	27
39	Pure Ground Bone,	John J. Smith, Trenton, N. J.,	Morrisville,	Sep. 17, '87	20.42	4.96	37 28	35 00	39
45	Pure Bone Meal,	Walker, Stratman & Co., Pittsburgh, Pa.,	Pittsburgh,	"	23.85	4.75	40 00	35 00	45
53	Raw Bone,	J. E. Tygert & Co., Philadelphia, Pa.,	"	"	25.28	4.60	40 92	33 00	53
55	Raw Bone Meal,	Allegheny City Fertilizer Works, Allegheny, Pa.,	Allegheny,	Sep. 24, '87	21.85	4.82	33 24	35 00	55
57	Coarse Ground Bone,	" " "	"	"	25.23	4.99	42 20	35 00	57
85	Slaughter-House Bone,	Joshua Horner, Jr., & Co., Baltimore, Md.,	Gettysburg,	Oct. 1, '87	20.08	6.26	40 36	31 00	85
91	Dessicated Bone,	Michigan Carbon Works, Detroit, Mich.,	Freeport,	Oct. 15, '87	26.69	8.34	38 05	36 00	91
94	Fine Bone Dust,	Keystone Fertilizer Company, Johnstown, Pa.,	Saltsburg,	"	22.31	4.55	37 65	36 00	94

TABULATED ANALYSES OF COMMERCIAL FERTILIZERS—Continued.

Sample Number.	Name of Fertilizer.	Name and Address of Manufacturer.	Where Selected.	Date of Analyses.	Phosphoric Acid.	Ammonia.	Comparative Commercial Value per ton.	Selling Price per ton at Point of Selection.	Sample Number.
107	Pure Bone Dust,	Vaughn, Bonsall & Co., Salem, Ohio,	Greensburg,	Oct. 22, '87	22.13	5.01	$39 16	$38 00	107
116	Superior Bone Meal,	Cleveland Dryer Company, Cleveland, Ohio,	Beaver Falls,	"	24.12	4.52	39 49	39 00	116
125	Azotized Bone,	Collins & Hardy, Mansfield, Pa.,	Mansfield,	Oct. 29, '87	12.51	7.28	37 26	30 00	125
126	Raw Bone Meal,	" "	"	"	23.72	4.71	39 73	35 00	126
132	Ground Bone,	Crocker Fertilizer Company, Buffalo, N. Y.,	Union City,	Nov. 5, '87	23.31	4.75	39 46	33 00	132
139	Ground Bone,	Schall Brothers, Erie, Pa.,	Erie,	"	19.78	4.41	34 77	34 00	139
140	Ground Bone,	Jarecki Chemical Company, Erie, Pa.,	"	"	20.31	4.85	36 80	33 00	140
168	Ground Bone,	Peninsular Fertilizer Company, Smyrna, Del.,	West Chester,	Nov. 18, '87	25.30	3.76	38 08	33 00	168
170	Swift-Sure Bone,	M. L. Shoemaker Company, Philadelphia, Pa.,	"	"	20.93	7.20	45 41	36 00	170
171	Bone Meal,	J. Richmond, Philadelphia, Pa.,	"	"	23.46	4.59	39 07	35 00	171
175	Pure Raw Bone,	Baugh & Sons' Company, Philadelphia, Pa.,	Media,	"	21.67	4.27	36 19	33 00	175
176	Button Bone,	L. Moritz, Philadelphia, Pa.,	"	"	25.00	4.99	41 96	35 00	176
177	Bone Meal,	Sharpless & Carpenter, Philadelphia, Pa.,	"	"	21.88	4.87	38 44	33 00	177
184	Fine Ground Bone,	Susquehanna Fertilizer Company, Baltimore, Md.,	Pottsgrove,	Oct. 29, '87	21.72	4.16	35 86	35 00	184
190	Pure Ground Bone,	E. M. Weaver, Riverside, Pa.,	"	"	23.79	5.36	41 01	35 00	190
198	Ground Bone,	Joseph Lister, Chicago, Ill.,	Goldsboro',	"	22.72	4.82	39 11	33 00	198
210	Fine Raw Bone,	N. W. Fertilizing Company, Chicago, Ill.,	Riverside,	Oct. 15, '87	23.47	4.62	39 18	37 00	210
219	Ground Bone,	Eureka Fertilizer Company, Perryville, Md.,	Oxford,	Oct. 22, '87	22.34	4.81	38 80	35 00	219
230	Pure Ground Bone,	W. C. Newport & Co., Willow Grove, Pa.,	Willow Grove,	Nov. 30, '87	21.24	5.15	38 73	32 00	230
231	Pure Raw Bone,	Jacob Trinley, Limerick Station, Pa.,	Linfield,	"	20.85	5.20	38 53	34 00	231
232	Star Ground Bone,	J. E. Tygert & Co., Philadelphia, Pa.,	Pottstown,	"	22.31	3.53	34 31	30 00	232

FARM WAGES AND BOARD OF FARM HANDS—'87.

COUNTIES.	By the month (whole year), with board.	By the month (summer months), with board.	By the day (regular work), with board.	By the day (regular work), without board.	By the month (whole year), with board.	By the month (summer months), without board.	By the day (transient work.)	Harvest wages.	Household help (female), by the week.	Estimated cost of boarding farm hands per day.
Adams,	$10 00	$12 00	$0 60	$0 90	$16 50	$19 00	$0 75	$1 15	$1 75	$0 30
Allegheny,	12 50	18 00	80	1 12	22 00	25 00	1 00	1 25	2 25	40
Armstrong,	12 00	13 00	75	1 00	21 00	30 00	1 25	1 50	1 50	30
Beaver,	12 00	18 00	75	1 25	20 00	25 00	1 00	1 25	2 50	48
Bedford,	11 00	14 50	50	80	15 00	20 00	60	1 10	1 20	32
Berks,	12 00	16 00	1 00	1 20	22 00	25 00	1 00	1 00	1 75	37
Blair,	12 00	15 00	75	1 00	15 00	20 00	1 00	1 25	2 00	24
Bradford,	12 75	15 00	74	1 00	17 00	18 50	1 00	1 30	2 00	38
Bucks,	13 00	16 00	1 00	1 25	17 00	20 00	1 00	1 75	2 00	30
Butler,	12 50	14 75	75	1 00	15 75	19 75	1 00	1 40	2 00	32
Cambria,	20 00	25 00	75	1 25	30 00	40 00	1 25	1 50	2 00	40
Cameron,	18 00	25 00	1 00	1 50	23 00	32 00	1 25	1 50	2 50	40
Carbon,	12 00	14 00	75	1 10	17 00	19 00	1 00	1 35	1 75	40
Centre,	12 00	14 00	75	1 00	16 00	18 00	1 00	1 25	2 00	30
Chester,	13 00	13 50	65	1 00	22 00	23 00	75	1 50	2 00	24
Clarion,	12 50	15 00	75	1 00	20 00	25 00	75	1 10	1 60	22
Clearfield,	13 00	15 00	75	1 00	21 00	25 00	75	1 15	2 00	37
Clinton,	15 00	13 00	65	1 00	20 00	25 00	75	1 00	1 00	30
Columbia,	12 00	14 00	75	1 00	18 00	20 00	1 00	1 25	1 50	30
Crawford,	12 00	15 00	75	1 00	21 50	23 00	1 10	1 50	2 00	32
Cumberland,	12 00	15 00	80	1 00	16 00	19 00	1 00	1 35	1 75	35
Dauphin,	12 50	14 00	75	1 00	22 00	24 00	1 00	1 25	1 75	33
Delaware,	14 50	18 00	75	1 10	20 00	25 00	1 10	1 30	2 25	40
Elk,	12 50	14 50	75	1 00	13 00	20 00	1 00	1 25	1 75	35
Erie,	10 00	14 00	1 00	1 30	14 75	18 50	1 25	2 00	2 50	44
Fayette,	12 50	16 00	1 00	1 25	18 00	25 00	1 50	1 50	2 00	30
Forest,	12 75	15 25	1 00	1 10	15 50	18 75	1 00	1 25	1 75	34
Franklin,	12 00	14 00	60	80	16 00	20 00	75	1 25	1 25	25
Fulton,	12 00	13 50	50	90	13 00	20 00	65	1 20	1 50	28
Greene,	13 75	15 75	70	90	13 00	24 00	70	1 10	1 75	28
Huntingdon,	15 00	18 00	95	1 25	30 00	35 00	1 30	1 75	2 25	27
Indiana,	13 00	15 00	75	1 00	13 00	25 00	1 25	1 30	1 50	40
Jefferson,	12 00	16 00	75	1 15	22 00	23 00	1 00	1 25	1 75	40
Juniata,	10 00	12 00	50	80	20 00	23 00	1 25	1 00	1 50	40
Lackawanna,	12 00	18 00	75	1 15	33 00	30 00	1 00	1 50	2 00	30
Lancaster,	15 00	17 00	60	1 00	25 00	27 50	65	1 25	1 50	40
Lawrence,	14 50	17 50	1 00	1 20	20 00	25 00	1 00	1 25	1 75	40
Lebanon,	13 00	15 00	75	1 10	25 00	30 00	1 00	1 25	1 75	32
Lehigh,	13 75	15 75	70	1 05	19 00	22 00	90	1 25	1 87	40
Luzerne,	15 00	18 00	1 00	1 25	28 00	35 00	1 50	2 00	2 00	31
Lycoming,	14 00	16 00	1 00	1 15	22 00	25 00	1 00	1 50	2 00	38
McKean,	12 75	14 50	75	1 00	17 00	19 00	85	1 35	1 75	35
Mercer,	12 00	15 00	75	1 00	18 00	22 00	1 25	1 50	2 50	45
Mifflin,	10 00	12 50	55	85	18 00	20 00	75	1 12	1 30	30
Monroe,	14 25	15 75	70	85	13 00	21 00	70	1 20	1 75	30
Montgomery,	16 00	20 00	95	1 30	25 00	30 00	1 20	1 75	2 50	35
Montour,	12 00	15 00	75	1 00	22 00	25 00	1 00	1 50	1 50	25
Northampton,	12 00	14 00	1 00	1 25	20 00	23 00	1 50	2 00	1 75	42
Northumberland,	10 50	12 75	75	1 00	20 00	25 00	1 10	1 25	1 75	30
Perry,	14 50	16 25	75	1 00	19 00	21 00	1 00	1 35	2 00	38
Philadelphia,	16 00	20 00	1 00	1 50	25 00	30 00	1 00	2 00	1 75	45
Pike,	14 00	16 00	1 00	1 25	20 00	24 00	1 10	1 50	2 00	40
Potter,	13 00	15 00	90	1 10	18 00	22 00	1 10	1 30	1 50	32
Schuylkill,	14 75	16 50	1 00	1 15	13 50	24 00	1 10	1 50	2 25	38
Snyder,	12 00	13 50	60	70	13 00	21 00	73	1 10	1 75	28
Somerset,	12 00	17 00	75	1 00	20 00	22 00	1 10	1 25	2 00	50
Sullivan,	16 00	20 00	1 00	1 40	25 00	30 00	1 20	1 40	2 50	42
Susquehanna,	13 50	17 50	87	1 10	20 00	25 00	1 25	1 75	2 50	38
Tioga,	15 00	18 50	1 15	1 25	22 00	23 50	1 25	1 75	2 25	40
Union,	11 00	13 50	78	1 10	19 00	21 00	1 00	1 35	1 80	34
Venango,	11 00	15 50	1 00	1 25	21 00	22 50	1 00	1 15	2 00	27
Warren,	13 00	16 00	90	1 15	17 00	22 00	1 00	1 50	2 75	30
Washington,	15 00	19 00	1 10	1 25	22 00	25 00	1 10	1 50	2 00	43
Wayne,	17 00	21 00	1 15	1 70	25 00	23 00	1 50	2 00	2 50	31
Westmoreland,	15 00	13 00	75	1 00	20 00	25 00	1 00	1 35	1 50	35
Wyoming,	14 50	17 00	90	1 20	25 00	23 00	1 05	1 50	1 75	40
York,	14 00	19 00	70	1 00	22 50	23 00	1 00	1 12	1 50	30

PRICES OF FARM PRODUCTS—1887.

Counties.	June 15 to July 15.								November 15 to December 15.						
	Wheat per bushel.	Rye per bushel.	Oats per bushel.	Potatoes (old) per bushel.	Potatoes (new) per bushel.	Hay (clover) per ton.	Hay (timothy) per ton.	Butter per pound.	Wheat per bushel.	Rye per bushel.	Oats per bushel.	Potatoes per bushel.	Hay (clover) per ton.	Hay (timothy) per ton.	Butter per pound.
Adams,	$0 75	$0 50	$0 28	$0 40	$0 75	$6 00	$9 00	$0 18	$0 75	$0 48	$0 25	$0 50	$6 00	$8 50	$0 20
Allegheny,	10	54	34	45	75	10 00	11 50	22	80	60	35	1 00	11 00	13 00	27
Armstrong,	90	60	38	35	75	8 00	12 00	15	80	56	32	75	6 75	9 25	22
Beaver,	88	60	40	60	1 00	8 00	10 00	20	87	55	35	65	7 00	9 00	18
Bedford,	95	60	35	40		7 50	8 75	12	93	57	33	40	7 75	9 00	15
Berks,	85	50	33	50	1 20	10 00	11 55	14	82	52	32	55	12 00	13 75	20
Blair,	90	60	32	80	1 40	7 00	9 00	15	90	58	34	70	9 50	10 50	15
Bradford,	90	61	34	75	1 10	7 50	9 00	20	92	59	33	72	8 50	9 00	20
Bucks,	87	61	33	75	1 05	10 00	12 50	27	85	50	32	90	10 00	12 00	21
Butler,	84	58	40	75	1 15	8 50	11 00	20	85	63	35	70	9 00	10 25	24
Cambria,	85	70	45	1 00	1 50	9 00	10 50	15	87	65	40	65	9 00	10 00	18
Cameron,	98	75	45	75		9 50	12 50	20	85	69	44	70	9 50	11 00	17
Carbon,	90	72	40	70	95	9 00	10 50	14	87	70	42	74	10 00	10 00	20
Centre,	90	57	32	75		8 75	10 00	13	85	58	32	65	8 25	10 25	17
Chester,	82	60	37	80	1 10	11 00	13 50	24	83	60	32	75	11 00	12 50	25
Clarion,	95	70	37	45		9 00	11 00	15	90	60	40	93	10 00	12 50	20
Clearfield,	92	70	37	40		9 00	10 00	14	91	59	32	87	9 50	10 00	19
Clinton,	90	56	35	60	1 40	8 00	10 00	15	89	57	33	79	9 00	10 00	22
Columbia,	90	60	35	65		10 00	12 00	14	88	59	34	80	9 75	10 00	23
Crawford,	80	60	35	60	1 00	7 75	9 00	14	87	60	33	89	10 00	11 00	23
Cumberland,	79	65	31	50	85	7 50	9 00	14	88	61	35	74	10 00	11 50	23
Dauphin,	83	55	30	57	1 00	7 00	9 00	18	89	64	37	75	10 00	11 25	21
Delaware,	94	70	41	75	1 15	10 00	12 00	23	90	60	34	90	11 00	12 50	27
Elk,	82	65	33	70	1 20	8 50	10 00	14	85	59	33	89	10 00	11 25	19
Erie,	80	50	35	50	87	7 75	9 00	17	88	58	32	87	9 50	10 75	20
Fayette,	80	56	36	80	1 10	8 00	9 75	20	84	58	37	83	9 00	10 00	23
Forest,	84	59	38	73	1 00	8 00	9 50	14	85	57	41	80	9 90	11 00	23
Franklin,	85	58	35	40	75	7 75	10 50	12	82	59	40	74	9 75	11 00	21
Fulton,	85	60	33	50	75	7 25	8 75	10	87	64	38	70	10 00	10 75	19
Greene,	90	70	40	70	1 15	9 00	10 00	14	85	63	37	65	10 50	11 00	20
Huntingdon,	85	56	3[illegible]	50	75	8 00	10 00	18	84	62	36	68	10 25	10 75	23
Indiana,	85	60	35	60	1 00	7 00	8 75	12	85	64	34	71	9 75	10 25	22
Jefferson,	90	70	44	50	87	8 00	10 00	11	80	60	42	90	11 00	12 50	18
Juniata,	85	60	35	60	1 10	10 00	11 00	12	87	60	33	72	8 00	9 50	19
Lackawanna,	90	54	45	60	1 20	9 00	11 75	18	90	57	34	80	10 00	11 50	22
Lancaster,	85	60	35	50		8 00	9 50	16	85	62	32	57	9 00	10 25	23
Lawrence,	80	50	35	60	87	8 00	11 00	12	81	54	31	65	8 50	9 75	18
Lebanon,	87	52	33	66	1 00	10 00	12 50	15	85	50	32	55	10 00	13 00	19
Lehigh,	92	70	40	90	1 20	9 00	11 00	18	90	65	38	70	9 25	10 50	20
Luzerne,	90	50	40	85	1 10	13 50	14 50	21	87	51	39	75	10 75	12 30	23
Lycoming,	85	68	37	75	1 10	10 00	12 00	18	80	60	35	60	10 00	12 50	22
McKean,	80	55	32	72	1 00	9 50	10 75	14	80	54	34	80	10 00	12 50	19
Mercer,	85	60	35	65	1 00	10 00	12 00	11	85	54	35	65	8 25	10 00	20
Mifflin,	90	60	30	60	1 15	10 00	11 00	15	88	55	30	65	10 00	12 00	22
Monroe,	88	69	40	67	1 00	9 00	10 25	14	85	54	32	67	9 00	9 75	18
Montgomery,	88	65	40	55	95	12 00	13 00	23	87	60	37	70	12 00	13 00	21
Montour,	85	65	32	70	1 00	8 50	10 75	18	82	60	30	60	8 25	10 00	20
Northampton,	90	58	35	65	1 00	10 00	12 50	17	83	54	35	70	10 00	13 00	25
Northumberland,	85	52	34	50		8 00	10 00	12	81	56	31	64	8 00	10 00	20
Perry,	90	59	38	80	1 15	8 25	11 00	14	82	56	32	75	10 00	12 00	20
Philadelphia,	90	55	42	75	1 25	12 00	16 00	30	85	55	38	78	12 00	14 00	30
Pike,	85	57	37	70	1 00	9 00	10 25	14	80	50	33	70	9 00	10 25	17
Potter,	87	58	39	70	1 10	9 50	10 50	13	85	57	34	74	9 00	10 00	18
Schuylkill,	89	59	41	70	1 15	10 00	12 00	17	87	54	34	77	10 00	12 00	22
Snyder,	90	48	32	45		12 00	13 50	18	79	54	32	57	8 00	10 00	17
Somerset,	85	60	40	60	1 00	8 00	9 25	11	80	57	35	80	7 75	9 00	19
Sullivan,	95	60	45	70	1 00	10 00	12 00	20	89	60	40	78	8 00	10 00	20
Susquehanna,	1 00	56	35	50		8 00	9 00	18	98	55	37	77	9 00	11 00	18
Tioga,	1 00	56	42	70	1 40	8 00	9 50	18	80	60	44	80	9 00	10 25	20
Union,	89	55	35	55	87	10 00	12 00	13	89	54	38	82	8 00	9 50	19
Venango,	87	65	35	50		10 00	12 50	19	85	65	37	80	12 00	13 50	22
Warren,	92	67	37	50		7 75	9 25	17	92	60	42	75	8 00	9 25	20
Washington,	80	50	34	70	1 25	8 00	9 75	12	90	52	35	80	9 00	9 75	18
Wayne,	1 00	60	40	60		7 00	8 75	18	95	58	35	81	8 50	9 00	17
Westmoreland,	85	55	35	1 00	1 30	8 00	10 00	20	76	52	30	75	9 00	10 00	21
Wyoming,	90	55	37	57	1 00	8 50	9 25	19	90	53	32	62	9 50	11 00	22
York,	87	51	33	52	1 25	8 00	10 00	14	80	53	29	60	8 00	10 00	22

VALUES OF LIVE STOCK—1887.

COUNTIES.	June 15 to July 15.						November 15 to December 15.				
	Ewes, average per head.	Lambs, average per head.	Horses, average.	Mules, average.	Cows, average.	Chickens (dressed) per pound.	Ewes, average per head.	Horses, average.	Mules, average.	Cows, average.	Chickens (dressed) per pound.
						cts.					cts.
Adams,	$3 00	$2 75	$100	$115	$25	10	$3 50	$90	$105	$25	9
Allegheny,	3 00	3 00	120	120	28	10	3 25	110	105	30	13
Armstrong,	3 00	2 50	110	115	25	8	2 75	110	110	33	10
Beaver,	3 00	2 75	125	100	25	8	3 00	120	95	30	8
Bedford,	3 ·0	2 50	130	105	25	9	3 00	115	100	28	10
Berks,	4 00	3 00	180	130	37	12	4 00	125	110	32	11
Blair,	3 00	2 60	145	140	30	10	3 25	135	130	31	10
Bradford,	3 00	3 00	140	140	30	9	3 00	130	125	28	9
Bucks,	4 00	4 00	150	165	38	13	4 00	140	130	44	11
Butler,	3 25	3 00	125	125	25	11	3 25	115	110	36	12
Cambria,	3 00	3 00	138	135	32	15	3 25	125	120	34	13
Cameron,	. .	. .	110	100	22	.	3 50	100	95	31	8
Carbon,	. .	. .	115	120	24	.	. . .	100	100	25	9
Centre,	2 75	2 75	125	130	25	10	3 00	120	120	35	10
Chester,	4 00	3 75	140	150	37	15	3 75	130	135	38	12
Clarion,	2 75	2 50	125	110	22	6	2 50	115	100	25	12
Clearfield,	. .	. .	135	125	25	7	. .	125	110	25	8
Clinton,	3 20	3 00	125	110	25	10	3 25	115	110	25	9
Columbia,	2 50	3 00	145	135	30	7	2 75	130	125	30	8
Crawford,	2 75	2 50	140	130	25	10	2 75	135	125	25	10
Cumberland,	3 25	3 00	110	115	30	14	3 25	100	100	30	10
Dauphin,	3 75	3 50	133	140	33	12	3 87	120	130	32	10
Delaware,	4 00	4 00	150	140	35	14	4 00	140	135	37	12
Elk,	.	.	125	115	25	8	.	110	115	25	8
Erie,	3 75	3 00	135	125	25	9	3 50	120	125	25	9
Fayette,	2 75	2 75	125	120	35	10	2 50	120	105	30	9
Forest,	. . .	. . .	120	100	24	9	. .	115	100	24	8
Franklin,	3 00	3 00	140	120	25	12	3 00	135	120	25	9
Fulton,	2 50	2 25	120	120	22	8	2 75	110	105	24	8
Greene,	3 25	3 00	125	120	27	11	3 00	110	115	25	9
Huntingdon,	3 00	2 75	125	120	30	10	2 75	115	115	30	8
Indiana,	2 75	2 50	140	130	28	10	2 75	120	120	27	9
Jefferson,	2 50	2 50	145	140	25	8	3 00	130	125	25	7
Juniata,	3 00	2 75	130	135	25	10	2 75	125	120	26	8
Lackawanna,	.	.	125	110	33	12	3 00	120	125	30	10
Lancaster,	3 50	3 75	160	140	38	10	3 50	150	125	34	9
Lawrence,	3 00	3 00	105	110	30	10	3 50	135	120	37	10
Lebanon,	3 75	3 50	140	135	26	13	3 75	130	120	27	8
Lehigh,	3 75	3 75	145	140	27	14	3 75	135	130	29	12
Luzerne,	3 50	3 50	155	160	33	12	3 50	140	125	30	10
Lycoming,	. .	. . . .	140	140	27	11	3 50	130	130	34	11
McKean,	. .	. .	130	130	25	9	. .	120	120	25	9
Mercer,	2 75	2 75	125	110	34	8	2 75	110	100	30	8
Mifflin,	2 75	2 75	135	125	25	8	3 00	125	120	30	9
Monroe,	3 00	2 50	135	130	27	11	3 00	120	110	28	9
Montgomery,	3 75	3 75	160	155	35	18	3 75	140	140	33	10
Montour,	3 50	3 00	145	130	30	12	3 50	130	120	35	10
Northampton,	4 00	3 25	150	150	30	12	3 25	130	125	38	13
Northumberland,	3 75	3 50	120	115	23	10	3 75	110	100	30	10
Perry,	.	.	138	140	27	11	3 00	125	130	30	10
Philadelphia,	4 25	4 50	190	175	38	16	4 30	180	150	40	14
Pike,			123	125	24	9	. .	120	110	25	8
Potter,	.		160	150	27	9	. .	140	130	30	9
Schuylkill,			140	130	30	9	3 00	125	125	30	8
Snyder,	3 00	3 00	145	105	32	9	3 00	125	100	30	9
Somerset,	3 00	2 25	105	100	25	10	2 75	100	100	30	12
Sullivan,	3 25	3 25	150	140	28	10	3 50	140	125	25	12
Susquehanna,	3 00	2 75	125	120	25	13	3 00	115	110	27	10
Tioga,	3 75	3 25	145	150	25	14	3 50	140	140	25	10
Union,	2 50	2 50	130	140	25	8	2 75	120	125	25	8
Venango,	2 25	2 25	110	115	33	11	2 50	110	115	35	14
Warren,	3 00	2 75	100	100	31	10	3 00	90	95	30	9
Washington,	2 75	2 75	123	115	30	11	2 75	115	100	30	9
Wayne,	3 50	3 00	140	130	30	12	3 50	130	120	30	9
Westmoreland,	3 25	3 25	130	125	25	9	3 50	125	120	30	10
Wyoming,	3 50	3 50	105	100	25	11	3 50	105	100	25	9
York,	3 00	3 50	125	135	25	8	3 75	125	125	30	8

LIST OF COUNTY AND LOCAL AGRICULTURAL SOCIETIES,

With Names and Addresses of Secretaries and Dates for holding Fall Exhibitions of 1887 (both days named included), Corrected up to January 1, 1888; Compiled from official reports and sources by the Pennsylvania Board of Agriculture.

Those marked with an * are represented in the Board of Agriculture by elected members.

County.	Corporate Name of Society.	Name and Address of Secretary.	Where Held.	Date of Last Fair.
	Pennsylvania State Agricultural Society,	D. W. Seiler, Harrisburg,	Philadelphia,	September 5-17.
	State Horticultural Association,	E. B. Engle, Waynesboro',	Holds no fair,	
	Tri-State Exposition,	R. H. Thomas, Mechanicsburg,	Williams Grove,	August 29-September 3.
Armstrong,*	Armstrong County Agricultural Society,	R. L. Peart, Kittanning,	Kittanning,	October 4-6.
Do.	Dayton Agricultural and Mechanical Association,	P. M. Enterline, Dayton,	Dayton,	September 27-30.
Do.	Petrolium Agricultural Society,	R. Balf, Parker's Landing,	Parker's Landing,	September 20-23.
Beaver,*	Beaver County Agricultural Society,	E. S. Weyand, Beaver,	Beaver,	September 27-30.
Do.	Mill Creek Valley Agricultural Association,	W. S. Stevenson, Hookstown,	Hookstown,	August 23-25.
Bedford,*	Bedford County Agricultural Society,	J. S. Gilchrist, Bedford,	Bedford,	October 4-7.
Berks,*	Berks County Agricultural and Horticultural Society,	C. T. Fox, Reading,	Reading,	September 20-23.
Do.	Keystone Agricultural Society,	S. H. Heffner, Kutztown,	Kutztown,	October 4-7
Blair,*	Blair County Agricultural Society,	A. P. Young, Hollidaysburg,	Hollidaysburg,	September 20-23.
Bradford,*	Bradford County Agricultural Society,	J. A. Codding, Towanda,	Towanda,	September 27-29.
Do.	Union Agricultural Association,	C. D. Derrah, Canton,	Canton,	September 20-22.
Do.	Troy Farmers' Club,	G. M. Card, Sylvania,	Troy,	September 13-16.
Bucks,*	Doylestown Agricultural and Mechanical Institute,	T. P. Miller, Doylestown,	Doylestown,	October 4-7.
Butler,*	Butler County Agricultural Society,	W. P. Roessing, Butler,	Butler,	September 13-16.
Carbon,	Carbon County Industrial Society,	E. Bauer, East Mauch Chunk,	Lehighton,	October 4-7.
Chester,*	Chester County Agricultural Society,	A. M. Enchus, West Chester,	West Chester,	September 21 23.
Do.*	Oxford Agricultural Society,	T. K. Stubbs, Oxford,	Oxford,	September 28-30.
Clarion,*	Clarion County Agricultural Society,	J. H. Patrick, Clarion,	Clarion,	September 27-30.
Clearfield,	Clearfield County Agricultural Society,	R. N. Shaw, Clearfield,	Clearfield,	September 27-30.
Clinton,*	Clinton County Agricultural Society,	J. C. McCloskey, Lock Haven,	Holds no fair,	
Columbia,*	Columbia County Agricultural Society,	H. V. White, Bloomsburg,	Bloomsburg,	October 12-15.
Do.	North'n Columbia and South'n Luzerne Agricultural Society,	J. W. Kurtz, Berwick,	Berwick,	September 21-24.
Do.	Benton Agricultural Society,	J. S. Kline, Benton,	Benton,	
Crawford,*	Crawford County Agricultural Society,	A. J. Harper, Conneautville,	Conneautville,	October 5-7.
Do.	French Creek Valley Agricultural Society,	J. H. Adams, Cochranton,	Cochranton,	September 14-16.

Crawford,	Oil Creek Valley Agricultural Society,	A. B. Kerr, Centreville,	Titusville,	September 21-24.
Do.	Woodcock Fair Association,	W. H. Rice, Woodcock,	Woodcock,	September 23 24.
Do.	C ntral Crawford Agricultural Society,	A. F. Moses, Cambridge,	Cambridge,	Sep ember 7-9.
Cumberland,*	Cumberland County Agricultural Society,	L. F. Lyne, Carlisle,	Carlisle,	September 27-30.
Dauphin,*	Dauphin County Agricultural Society,	W. H. H. Seig, Steelton,	Harrisburg,	No fair.
Do.	Gratz Agricultural Society,	J. W. Hoffman, Gratz,	Gratz,	September 20-24.
Delaware,*	Delaware County Agricultural Society,	H. C. Snowden, Media,	Elwyn,	September 29-October 1.
Elk,	Elk County Agricultural Society,	I. H. Gifford, St. Mary's,	St. Mary's,	October 4-7.
Erie,*	Erie County Agricultural Society,	G. A. Evans, West Mill Creek,	Erie,	September 20-23.
Do.	North-Western Agricultural Association,	J. Smutz, Corry,	Corry,	September 27-30.
Do.	Wattsburg Agricultural Society,	W. H. Harwood, Wattsburg,	Wattsburg,	October 4-6.
Do.	Edinboro' Agricultural Society,	S. E. Phipps, Edinboro',	Edinboro',	September 14-16.
Do.	Central Agricultural Society of Union City,	A. G. Sweet, Union City,	Union City,	No fair.
Fayette,	Fayette County Agricultural Society,	R. F. Hoppwood, Uniontown,	Uniontown,	October 4-7.
Fulton,	Fulton County Agricultural Society,	J. W. Greathead, McConnellsburg,	McConnellsburg,	No fair.
Greene,	Greene County Agricultural Society,	G. W. Dougherty, Carmichaels,	Carmichaels,	October 12-13.
Do.	Waynesburg Central Agricultural Society,	R. F. Downey, Waynesburg,	Waynesburg,	September 20-23.
Indiana,*	Indiana County Agricultural Society,	T. T. Stuchul, Indiana,	Indiana,	October 4 7.
Jefferson,*	Jefferson County Agricultural Society,	S. H. Whitehill, Brookville,	Brookville,	September 20-23.
Do.	Punxsutawney Agricultural Society,	T. J. Cooper, Punxsutawney,	Punxsutawney,	September 20-23.
Juniata,*	Juniata County Agricultural Society,	J. P. Wharton, Port Royal,	Port Royal,	October 4-7.
Lackawanna,*	Lackawanna County Agricultural Society,	D. M. Jones, Scranton,	Scranton,	September 20-23.
Do.	North Lackawanna Farmers' Association,	J. L. Stone, Waverly,	Holds no fair,	
Lancaster,*	Lancaster County Agricultural Society,	J. C. Linvill, Gap,	Lancaster,	Holds no fair.
Do.	Lancaster County Fair Association,	J. B. Long, Lancaster,	Lancaster,	August 30-September 2.
Do.	Farmers' Fair Association,	J. F. Bomberger, Lititz,	Lititz,	October 4-7.
Lebanon,*	Lebanon Valley Agricultural and Mechanical Association,	C. R. Lantz, Lebanon,	Lebanon,	September 26-30.
Lehigh,*	Lehigh County Agricultural Society,	L. P. Hecker, Allentown,	Allentown,	
Luzerne,*	Luzerne County Agricultural Society,	S. W. Townend, Wilkes-Barre,	Wyoming,	September 27-30.
Do.	Dallas Union Agricultural Society,	H. Hall, Dallas,	Dallas,	October 4-7.
Lycoming,*	Muncy Valley Farmers' Club Agricultural Society,	E. Michael, Hughesville,	Hughesville,	September 28-30.
McKean,	McKean County Agricultural Society,	A. J. Hughes, Port Allegheny,	Port Allegheny,	September 13-16.
Mercer,*	Mercer County Agricultural Society,	J. P. Hines, Stoneboro',	Stoneboro',	September 28-30.
Do.	Mercer Central Agricultural Society,	W. J. McKean, Mercer,	Mercer,	September 21-23.
Do.	Keystone and Buckeye Agricultural Society,	T. B. Bell, Sharon,	Sharon,	No fair.
Mifflin,	Mifflin County Agricultural Society,	S. L. McKinney, Lewistown,	Lewistown,	No fair.
Monroe,	Monroe County Agricultural Society,	R. B. Keller, Stroudsburg,	Stroudsburg,	September 27-October 1.
Montgomery,*	Montgomery, Chester and Berks Agricultural Society,	E. P. Ancona, Pottstown,	Pottstown,	September 27-30.
Montour,*	Montour County Agricultural Society,	W. B. Baldy, Danville,	Danville,	October 5-8.
Do.	Northern Montour Agricultural Society,	C. E. Shires, Washingtonville,	Washingtonville,	October 18-21.
Northampton,*	Northampton County Agricultural Society,	E. T. Grunewald, Nazareth,	Nazareth,	October 4-7.
Do.	Farmers' and Mechanics' Institute,	Thomas Rinek, Easton,	Easton,	September 13-16.
Northumberland,*	Milton Driving Park and Fair Association,	W. B. Chamberlain, Milton,	Milton,	
Perry,	Perry County Agricultural Society,	J. B. Eby, Newport,	Newport,	September 20-23.
Potter,	Potter County Agricultural and Horticultural Society,	A. B. Mann, Coudersport,	Coudersport,	

COUNTY AND LOCAL AGRICULTURAL SOCIETIES—Continued.

County.	Corporate Name of Society.	Name and Address of Secretary.	Where Held.	Date of Last Fair.
Schuylkill,*	Schuylkill County Agricultural Society,	R. S. Fey, Orwigsburg,	Orwigsburg,	September 27-30.
Do.	Ringtown Agricultural Society,	I. Applegate, Shenandoah,	Ringtown,	September 21-23.
Sullivan,*	Sullivan County Agricultural Society,	A. D. Strong, Dushore,	Forksville,	October 4-7.
Susquehanna,*	Susquehanna County Agricultural Society,	D. A. Titsworth, Montrose,	Montrose,	October 4-6.
Do.	Harford Agricultural Society,	L. Tiffany, Harford,	Harford,	September 28-29.
Do.	Keystone Agricultural Society,	J. W. Dusenbury, Great Bend,	Great Bend,	September 14-16.
Tioga,*	Farmers' Agricultural Society of Tioga County,	J. W. Mather, Wellsboro',	Wellsboro',	September 20-23
Do.	Smythe Park Association,	J. E. Mathew, Mansfield,	Mansfield,	September 27-30.
Union,*	Union County Agricultural Society,	R. S. Kline, Lewisburg,	Lewisburg,	September 21-24.
Venango,*	Venango County Agricultural Society,	J. Miller, Franklin,	Franklin,	September 6-9.
Warren,*	Warren County Agricultural Society,	A. S. Dalrymple, Warren,	Warren,	August 30-September 2.
Washington,*	Western Pennsylvania Agricultural Society,	A. G. Happer, Washington,	Washington,	September 13-16.
Do.	Union Agricultural Association,	W. Melvin, Burgettstown,	Burgettstown,	October 4-7.
Wayne,*	Wayne County Agricultural Society,	T. J. Ham, Honesdale,	Honesdale,	
Westmoreland,*	Westmoreland County Agricultural Society,	J. B. Laux, Greensburg,	Greensburg	October 11-14.
Wyoming,*	Wyoming County Agricultural Society,	J. W. Platt, Tunkhannock,	Tunkhannock,	September 14-16.
York,*	York County Agricultural Society,	E. Chapin, York,	York,	October 4-7.
Do.	Hanover Agricultural Society,	M. O. Smith, Hanover,	Hanover,	September 20-23.

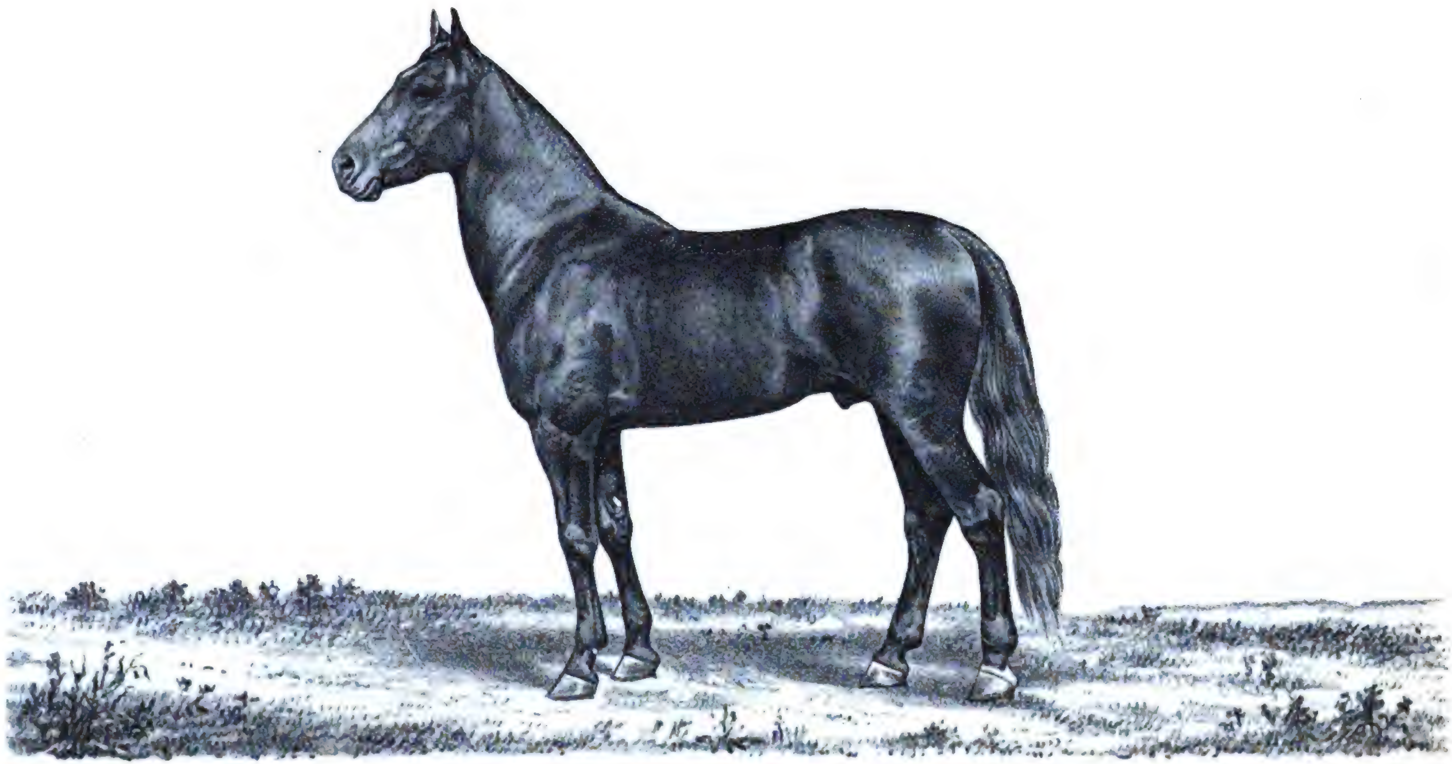
TABULAR STATEMENT OF THE RECORDS OF THE WEATHER, KEPT AT QUAKERTOWN, PA., FOR THE YEAR ENDING NOVEMBER 30, 1887, BY J. L. HEACOCK, PENNSYLVANIA STATE WEATHER SERVICE, AND METEOROLOGIST OF THE PENNSYLVANIA BOARD OF AGRICULTURE.

	December, 1886.	January, 1887.	February, 1887.	March, 1887.	April, 1887.	May, 1887.	June, 1887.	July, 1887.	August, 1887.	September, 1887.	October, 1887.	November, 1887.	Averages and amount of rainfall, etc., for the year.
Highest temperature,	49.00	55.00	56.00	47.00	80.00	83.00	87.00	90.00	85.7	84.5	82.2	67.0	72.2
Lowest temperature,	6.00	1.00	9.00	13.00	22.00	42.00	43.00	60.00	44.0	33.0	28.0	18.0	26.1
Average temperature,	25.93	27.55	30.57	30.36	45.10	62.00	65.60	71.80	66.0	58.4	49.1	38.7	47.50
Greatest temperature, mean,	33.39	34.19	39.14	38.39	56.80	73.77	76.60	78.00	76.6	69.5	61.8	50.0	57.18
Lowest temperature, mean,	17.81	16.39	32.00	22.16	33.43	50.54	54.66	67.60	58.5	52.2	37.6	25.9	38.26
Daily range of temperature, greatest,	31.00	29.00	31.00	26.00	39.00	34.00	37.00	25.00	28.5	33.0	36.2	34.0	32.2
Daily range of temperature, least,	6.00	8.00	6.00	9.00	10.00	11.00	11.00	1.00	6.0	5.0	7.7	4.7	7.2
Daily range of temperature, average,	16.00	18.00	12.00	16.09	23.36	23.09	21.93	10.00	18.2	20.4	21.7	20.8	18.46
Monthly range of temperature,	43.00	54.00	47.00	34.00	58.00	41.00	41.00	30.00	41.7	51.5	59.2	49.00	46.03
Barometer, highest,	29.81	29.91	30.18	29.95	29.93	29.61	29.66	29.50	29.61	30.45	30.44	30.81	29.16
Barometer, lowest,	28.82	28.75	28.65	28.63	28.57	28.88	29.04	29.00	29.02	29.64	29.62	29.04	28.97
Barometer, average,	29.41	29.32	29.49	29.50	29.30	29.36	29.34	29.35	29.33	30.14	30.05	30.06	29.55
Barometer, daily fluctuations, average,	.09	.12	.15	.09	.11	.05	.07	.06	.06	.08	.26	.17	.11
Amount of rainfall and melted snow,	2.43	3.88	4.05	2.08	1.79	2.99	4.56	9.25	4.75	3.52	1.70	1.56	42.56
Number of days upon which rain and snow fell,	9.00	9.00	13.00	7.00	5.00	5.00	7.00	12.00	9.00	10.00	12.00	5.00	103.00
Number of days fair,	5.00	2.00	1.00	1.00	8.00	2.00	8.00	6.00	3.00	4.00	4.00	3.00	47.00
Number of days clear,	10.00	13.00	9.00	8.00	11.00	20.00	14.00	10.00	8.00	9.00	5.00	7.00	124.00
Number of days cloudy,	7.00	7.00	5.00	15.00	6.00	4.00	1.00	3.00	11.00	7.00	10.00	15.00	91.00
Prevailing winds,	W.	W.	N. E.	W.	W.	N. E.	N. E.	S. E.	N. E.	N. E.	N. E. & W.	W. & N. W.	N. E. & W.

Remarks.—Elevation of surface of mercury in cistern of barometer above sea level, about 536 feet. Corrections for instrumental error used, .246 part of the time and .140 part of time, and every observation reduced to 32 degrees, and from August the balance of time to sea level. Kind of rain-gauge, signal service, located 6 feet above ground. Self-registering thermometer used. Daily mean temperature is for the 24 hours. No unusual weather to note for the past year, except an unusual quantity of rainfall in July, and during the months of July and August several severe thunder and wind storms, which did considerable damage in this locality by lightning, uprooting trees, destroying fences, but not much damage to buildings. The crops were generally up to the average, except the wheat crop, which was almost a failure. Caterpillars were quite numerous, and damaged the trees considerably by eating the foliage. The number of rainy days is based upon the fact that .01 inches or more of rain or snow fell. The number of fair days is based upon the sky being covered from $\frac{3}{10}$ to $\frac{7}{10}$ with clouds. The number of clear days is based upon the sky being covered $\frac{3}{10}$ or less with clouds. The number of cloudy days is based upon when the sky is covered with clouds from $\frac{7}{10}$ to wholly covered.

METEOROLOGICAL SUMMARY.—Pennsylvania State College Agricultural Experiment Station Observatory, December 1886, to December 1887.

Month.	Temperature (Degrees Fahrenheit). Mean, 7 A. M.	Mean, 2 P. M.	Mean, 9 P. M.	Monthly mean.	Absolute maximum.	Absolute minimum.	Absolute range.	Mean maximum.	Mean minimum.	Mean daily range.	Greatest daily range.	Mean humidity.	Precipitation. Total rainfall.	Snowfall.	Number of days when rainfall =.01 inch or more.	Cloudiness. Monthly mean.	Number of days when cloudiness = 8 to 10.	Total wind record.
												Per cent.	Inches.	Inches.				Miles.
December, 1886,	21.0	28.0	22.4	23 4	59.0	3.0	56.0	30.7	15.6	15.1	48.0	.	1 51	9.00	9	5.4	10	
January, 1887,	21.5	28 6	25 3	24 6	38.0	−7 0	65.0	32 3	15 9	16.4	35.0		1.25	2 75	8	6.4	11	3 402
February, 1887,	28.5	34 0	30.5	30 8	63.0	8.0	55.0	37.2	24 2	13.0	24.0	87.3	5.60	12.50	13	6 8	13	4 657
March, 1887,	27.1	35 4	30.0	30 6	60 0	11.0	49.0	38.6	21 2	17.4	37.0	82.4	1.03	2 50	5	6 2	14	5 065
April, 1887,	42 1	53 2	44 0	45 9	79 0	17 0	62 0	56 0	37.1	18 9	36.5	74 6	2 23	3 12	9	4.7	8	2 384
May, 1887,	60.9	73 2	62 8	64.9	83 0	41.0	47 0	75.8	53 3	22.5	35 0	73 0	2.11		13	4 4	6	1 360
June, 1887,	66 9	75.4	65 3	68 2	89 0	45.0	44.0	78 7	58 4	22 3	37.0	77 0	3.65	. . .	12	4 6	8	801
July, 1887,	74.8	84 0	72 9	76 2	97.0	56 5	40.5	86 3	65.4	20.9	32 0	67.0	4 63		16	4.5	7	1.012
August, 1887,	64 6	75 7	65 1	67.6	89.5	40.0	49 5	78 5	55 8	22 7	39.0	77 3	2 10	. .	14	4.3	3	1 322
September, 1887,	55.5	66.0	57.7	59.2	82 0	32 0	50 0	67.7	47.4	20 3	30 0	71.0	3 60		8	5 1	9	84[illegible]
October, 1887,	45.3	54 6	47 0	43.5	78 0	12.0	66 0	57 6	33 2	19.4	37.0	73 9	0.46		8	5.9	11	1,680
November, 1887,	35.9	44.6	36 8	38.3	70.0	8 5	61.5	46.6	27.6	19.0	43.0	78.0	1.44	0.75	8	5.3	9	2,194
Means December, 1886, to December, 1887,	45 3	54 4	43.6	48.2	76.0	22.3	53.8	57.2	38.2	19.0	36 9	76.7	2.40	. .	10.3	5.3	9	2,192 5



MOGUL. (No. 1724.)

SIRE, ADMINISTRATION. DAM, MARY A. WHITNEY. WINNER FIRST PRIZE, EXHIBITION PENNSYLVANIA STATE FAIR, 1886. STALLION OVER 5 YEARS. OWNED BY AVONDALE STOCK FARM ASSOCIATION, AVONDALE, CHESTER CO., PA.

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OF THE

PENNSYLVANIA

STATE AGRICULTURAL SOCIETY,

1887.

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Crawford, Albert, Philadelphia.

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Euhbaum, William, Pittsburgh.
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Ellis, William, Philadelphia.
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Elder, Mathias, Williamsport.
Elliot, William G., Williamsport.
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Elliott, W. R., Pittsburgh.
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Embick, Frederick E., Williamsport.
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Eppes, W. J., Williamsport.
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Ever, Andrew, Muncy.
Eves, George S., Williamsport.
Eveland, S. D., Williamsport.
Evender, Thomas, Williamsport.
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Farrell, John, Philadelphia.
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Fisler, Amos, Harrisburg.
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Gilmore, Joseph, Williamsport.

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Gibson, John, Williamsport.
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Glenn, Robert A., Noblestown.
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Goe, John S., Jr., Brownsville.
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Greenawalt, Alexander, Allegheny City.
Griffin, Henry, Scranton.
Grout, H. T., Philadelphia.
Grass, D. W., Harrisburg.
Grove, M. M., Harrisburg.

Hacket, John M., Easton.
Hacker, William, Philadelphia.
Haddock, D. J., Philadelphia.
Haehnlen, Frederick P., Harrisburg.
Haehnlen, William, Harrisburg.
Haehnlen, Jacob, Harrisburg.
Hageman, Augustus H., Williamsport.
Hagg, Philip, Williamsport.
Hain, George, Lower Paxton, Dauphin co.
Haldeman, Jacob S., New Market.
Hall, George B., Philadelphia.
Hall, John B., Williamsport.
Hall, John W., Harrisburg.
Halstead, N., Scranton.
Halstead, W. F., Scranton.
Hamilton, Hugh, Harrisburg.
Hamilton, A. Boyd, Harrisburg.
Hamilton, Hays, Huntingdon Furnace.
Hamilton, Cyrus E., Williamsport.
Hartman, John, Williamsport.
Hartman, Mathias, Catawissa.
Harrington, T. L., Williamsport.
Harvey, Chalkley, Chadd's Ford.
Hastings, H. S., Williamsport.
Hays, J. W., Williamsport.
Hazeltine, John, Philadelphia.
Herdic, Peter, Williamsport.
Hetrick, Josiah P., Easton.
Herdler, David, Williamsport.
Heaton, William, Jr., Philadelphia.
Heck, Lewis, M. D., Dauphin.
Hepburn, Andrew, Williamsport.
Hepburn, John, Williamsport.
Helick, Reuben, Easton.
Hemmingway, E. E., Easton.
Herr, Henry, Harrisburg.
Herr, D. S., Harrisburg.
Herriott, W. A., Oakdale, Allegheny co.
Hester, Joseph M., Easton.
Heylmun, E G., Crescent.
Hickok, W. O., Harrisburg,
Hiester, A. O., Harrisburg.
Hicks, James, Pittston.
Hickman, Amos S., Monticello, Ill.
Higgins, William C., Williamsport.
Higgins, William V., Williamsport.
Hill, Theodore, Williamsport.
Hill, J. F., Scranton.
Hildrup, W.F., Harrisburg.
Hinkle, John R., Newberry.
Hinckley, Isaac, Philadelphia.
Hise, Adam, Williamsport.
Hitner, H. S., Barren Hill.
Hoffer, John, Harrisburg.
Hoffman, H. W., Harrisburg.
Hoffman, Philip, Philadelphia.
Hoffman, H. B., Millersburg.
Hollenbach, George M., Wilkes-Barre.
Holliday, B. B., Wellsboro'.
Hollingsworth, Samuel S., Philadelphia.
Holstein, W. K., Bridgeport.
Holdin, H. L., Williamsport.
Hoopes, Thomas P., Philadelphia.
Hoopes, Clement R., Philadelphia.
Horstman, F. O., Philadelphia.
Horstic, John, Harrisburg.
Howell, A., Williamsport.
Howland, Ransford, Williamsport.
Honedry, Monsein, Renova.
Houston, H. H., Philadelphia.
Hudson, James E., Williamsport.
Hugus, P., Pittsburgh.
Hull, Joseph F., Hull's Mills.
Hull, W. R., Cogan Station.
Hummel, William, Harrisburg.
Hummel, S. A., Harrisburg.
Hunter, George W., Harrisburg.
Hutchinson, S. Pemberton, Philadelphia.
Hutter, William H., Harrisburg.
Hutchins, Thomas, Wyoming.
Huling, G., Williamsport.
Huyck, George, Newberry.
Hynicka, George A., Harrisburg.

Ingersoll, Harry, Philadelphia.
Innis, John, Easton.
Irwin, James, Philadelphia.

Jamison, Edward, Newberry.
Jamison, L., Williamsport.
Jarrett, John, Hepburn.
Jayne, Eben C., Philadelphia.
Jefford, A. H., Wyoming.
Jennison, E. P., Philadelphia.
Jenkins, G. S., Wyoming.
Jenkins, Steuben, Wyoming.
Jetter, Tuesley, Bethlehem.
Johnson, William, Easton.
Jones, Daniel, Exeter, Luzerne county.
Jones, John E., Williamsport.
Jones, Samuel, Williamsport.
Jones, B. F., Pittsburgh.
Jones, W. H., Philadelphia.
Jordan, John, Philadelphia.
Jordan, Thomas J., Harrisburg.

Kapp, Amos E., Northumberland.
Keely, Jerome, Philadelphia.
Keim, George DeB., Philadelphia.
Keller, John S., Orwigsburg.
Kennedy, A. L., M. D., Philadelphia.
Kennedy, Thomas B., Chambersburg.
Kendig, John, Philadelphia.
Kent, E. E., Syracuse, New York.
Kepple, John, Harrisburg.
Ketterleinus, J. W., Philadelphia.
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King, Alexander, Pittsburgh.
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Knapp, D. B., Williamsport.
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Kuhn, William, Harrisburg.

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Landreth, Leopold.
Landreth, Burnet, Jr.
Landreth, S. Phillips.
Languerrene, P. L., Philadelphia.
Lafrance, Isaac T., Wyoming.
Larvall, Edward, Easton.
Lee, Washington, Jr., Wilkes-Barre.
Leacock, J. N., Wyoming.
Leser, Frederick K., Philadelphia.
Lehman, M., Williamsport.
Lemon, John A., Hollidaysburg.
Lentz, George W., Williamsport.
Lerch, Frederick, Easton.
Levan E., M. D., Williamsport.
Line, J. M., Allentown.
Lippincott, Edward, Williamsport.
Logan, Millard F., Williamsport.
Long, H. B., Pittsburgh.
Long, W. J., Osceola.
Longaker, A. B., Norristown.
Longstreth, John, Bristol.
Love, Samuel, Williamsport.
Lowe, Elias P., Williamsport.
Lukenbaugh, C. A., Bethlehem.
Lyon, Thomas, Williamsport.

Mackey, L. A., Lock Haven.
Mahaffey, William J., Newberry.
Mahaffey, Lindsey, Newberry.
Mahaffey, David, Cogan Station.
Magan, David, New Brighton.
Magee, George, Philadelphia.
Magee, James, Philadelphia.
Marshall, William, Bellefonte.
Martin, George H., Philadelphia.
Martin, Dewees J., Allentown.
Marchard, John, Pittsburgh.
Mark, George M., Harrisburg.
Marvin, Selden, Erie.
Marcy, Ira, Wilkes-Barre.
Maxwell, Jacob S., Williamsport.
Mallor, Thomas, Philadelphia.
Mellon, Thomas, Philadelphia.
Meredith, James M., Calcium.
Merrick, George, Northumberland.
Metzar, William, Harrisburg.
Messinger, Samuel, Easton.
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Miller, Larr., Wayne, Clinton county.
Miller, J. G., Harrisburg.
Miller, John M., Hickory.
Miller, John S., Huntingdon.
Miles, James, Miles Grove.
Monday, S. S., Williamsport.
Montgomery, J. B., Williamsport.
Montgomery, James, Harrisburg.
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Mutchler, John, Easton.
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Myers, Henry, Forty Fort.
Meyers, Charles E., Philadelphia.
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McCaine, Daniel, Allegheny City.
McCaughey, J. A., Philadelphia.
McConkey, Elbridge, Harrisburg.
McClure, A. K., Philadelphia.
McCrea, William H., Philadelphia.
McCormick, Robert, Montoursville.
McCully, Francis G., Philadelphia.
McDonald, Lewis, Harrisburg.
McDowell, John, Washington.
McFarland, John, Ligonier.
McFarland, George F., Harrisburg.
MacKellar, Thomas, Philadelphia.
McKean, Samuel M., Williamsport.
McKean, H. P., Philadelphia.
McKean, James S., Pittsburgh.
McLowell, Lewis, Williamsport.
McMinn, J. M., Williamsport.
McMickin, J. B., Williamsport.
McNish, A. L., Pittsburgh.
McPherson, Edward, Gettysburg.
McPherson, J. S., Wilkins.

Neilson, Robert, Philadelphia.
Neiman, D. H., Easton.
Newton, G. B., Springfield, Delaware co.
Nicely, George W., Newbury.
Nichols, James, Williamsport.
Nichols, W. F., Williamsport.
Nissley, John F., Hummelstown.
Nissley, Joseph, Harrisburg.
Noble, John, Carlisle.
Noble, F. W., Easton.
Nutting, Lyman, Pine Grove, Schuylkill county.

Odenweider, H. L., Easton.
Olewine, Benjamin, Harrisburg.
Opp, George S., Maryland, Lycoming county.
Ott, Leander, Harrisburg.
Otsott, Jacob H., Harrisburg.

Page, A., Williamsport.
Palmer Henry, Avondale.
Parsons, H. K., Harrisburg.
Parsons, Leroy, Harrisburg.
Parsons, H. C., Williamsport.
Parsons, George W., Harrisburg.
Parke, John E., Pittsburgh.
Parker Samuel J., Williamsport.
Patterson, Robert H., Pittsburgh.
Patterson, Lebanon Church, Allegheny county.
Patterson, John, Glenmore.

Paxson, J. A., Philadelphia.
Pemberton, Clifford, Pittsburgh.
Pennock, Samuel, Kennett Square.
Pennock, Joseph, Harrisburg.
Perkins, H. J., Williamsport.
Perkins, James E., Lemar.
Perrott, W. S., Philadelphia.
Peters, C. P., Concordville.
Peyson, August, Philadelphia.
Phelps, W. H., Pittsburgh.
Phillips, John, Pittsburg
Pollock, Samuel, Williamsport.
Polin, Albert, Wyoming.
Pomroy, John L., Philadelphia
Post, G. S., Williamsport.
Porter, John F., Newberry.
Postlethwaite, E. S., Philadelphia.
Potts, E. Channing, Norristown.
Pownell, Ambrose, Philadelphia.
Pratt, Thomas, Philadelphia.
Presbury, George G., Jr., Philadelphia.
Pritchett, Borrodale, Frazier.
Pugh, Charles E., Philadelphia.
Purcell, Sylvester, Bloomsburg.
Pyle, R. C., Easton.

Rank, L. D., Williamsport.
Raymond, James, Harrisburg.
Reed, Alexander, Lock Haven.
Reed, James, Harrisburg.
Reed, E. W., Erie.
Reeder, Mrs. A H., Easton.
Reigel, James, Easton.
Rughard, James, Newberry.
Reighard, Daniel, Newberry.
Reily, John A., Harrisburg.
Reel, Augustus, Harrisburg.
Reel, John, Harrisburg.
Remінger, W. H., Williamsport.
Rhey, George, Millwood,
Rhodes, Wm. A., Philadelphia.
Richards, Henry, Easton.
Richmond, Wm. H., Carbondale.
Risler, J. D., Philadelphia.
Road, Jacob, Pittsburgh.
Roberts, Algernon S., Philadelphia.
Roberts, George B., Philadelphia.
Robinson, —— Philadelphia.
Rodgers, Fairman, Philadelphia.
Rodenbaugh, James S., Easton.
Rogers, C. B., Philadelphia.
Rogers, C. R., Philadelphia.
Rogers, Lucius, Smethport.
Rogers, Felix, Pittsburgh.
Rook, D. N., Williamsport.
Ross, William S., Wilkes-Barre.
Roth, Jeremiah, Allentown.
Rouse, William A., Harrisburg.
Rowley, Thomas A., Pittsburgh.
Rudy, Joseph, Harrisburg.
Rudman, William C., Philadelphia.
Ruggles, A. C., Williamsport.
Runk, William M., Philadelphia.
Rupp, H. S., Shiremanstown.
Rutter, Nathaniel, Wilkes-Barre,
Rutherford, Abner, Harrisburg.
Rutherford, John B., Harrisburg.
Rutherford, W. F., Harrisburg.
Rutherford, William S., Harrisburg.
Rutherford, F. W., Harrisburg.
Rutherford, J. F., Harrisburg.
Rutherford, Silas B., Harrisburg.
Rutherford, J. Q. A., Harrisburg.
Rutherford, S. Parke, Cochranville, Chester county.

Saxton J. O., Mechanicsburg.
Savery, Peleg B., Philadelphia.
Schall, David, Norristown.
Schreiber, O. L., Laubach.
Schreiner, J. W., Lewisburg.
Schasley, J. B., Wyoming.
Scull, Gideon, Philadelphia.
Scott, John, Pittsburgh.
Scott, W. H., Philadelphia.
Seitz, George, Easton.
Seitz, Frederick, Easton.
Seiler, Daniel W., Harrisburg.
Seltzer, George L., Myerstown.
Serch, David, Easton.
Shaffer, Wm. S., Harrisburg.
Shaner, Jefferson, West Chester.
Sharp, James W., Philadelphia.
Sharp, John, Jr., Wyoming.
Sharpless, S. J., Street Road, Chester county.
Shaw, Hugh, Jersey Shore.
Sheffler, A. G., Williamsport.
Sheets, J. H. Van, Orwigsburg.
Shoemaker, B. A., Philadelphia.
Shoemaker, William M., Wyoming.
Shoemaker, William S., Wyoming.
Shoemaker, Elijah, Kingston.
Shoemaker, John J., Harrisburg.
Showers, Jesse, Rauch Gap.
Shyrock, W. Knight, Philadelphia.
Sigman, James, Easton.
Silkman, W. M., Scranton.
Silverthorn, M. H., Fairview, Erie county.
Simon John B., Harrisburg.
Singer Manufacturing Company, Philadelphia.
Singerly, W. M., Philadelphia.
Slade, Alfred, Philadelphia.
Small, Henry, York.
Smith, George Handy, Philadelphia.
Smith, Daniel, Jr., Philadelphia.
Smith, Philip L., Philadelphia.
Smith, William B., Philadelphia.
Smith, Mahlon K., Philadelphia.
Smith, H. K., Philadelphia.
Smith, J B., Dunmore.
Smith, Henry B., Williamsport.
Smith, Thomas, Williamsport.
Smith, Daniel W., Williamsport.
Smith, J. B., Plymouth.
Smith, James W., Newberry.
Smith, J. D. L., Mill Hall.
Smith, George, New York city.
Smith, Jacob, Harrisburg.
Snow, Edward K., Philadelphia.
Snyder, Daniel W., Easton.
Sower, F. D., Norristown.
Spencer, S. S., Lancaster.
Speer, William W., Pittsburgh.
Stambaugh, S. C., Lancaster.
Starr, Isaac, Philadelphia.
Stavely, J. Thomas, Philadelphia.
Stearns, L. L., Williamsport.
Steel, John M., Greensburg.
Steel, William, Greensburg.
Stephens, Z., Scranton.
Stewart, Robert, Limar.
Stokes, T. P. C., Philadelphia.
Strouble, Jacob, Zion, Centre county.
Stuart, George H., Philadelphia.
Sturdevant, E. J., Wyoming.
Sturdevant, E. W., Wilkes-Barre.
Swan, Rufus C., Williamsport.
Swift, Joseph, Philadelphia.

Taggart, David, Northumberland.
Tasker, Thomas T., Philadelphia.
Tatham, H. B., Philadelphia.
Tatham, George N., Philadelphia.
Taylor, Benjamin H., Williamsport.
Taylor, Horace E., Williamsport.
Taylor, William, Womelsdorf.
Taylor, B. Frank, Womelsdorf.
Taylor, George R., Womelsdorf.
Templin, James R., Easton.
Templin, Wm., Harrisburg.
Thatcher, Richard, Marsh, Chester co.
Thayer, Russell A., Allentown.
Thompson, John I., Half Moon, Centre co.
Thompson, N. B., Philadelphia.
Thompson, James, Cogan Station.
Thompson, Frank, Philadelphia.
Thomas, Richard, Whitford, Chester co.
Tinsmann, Garrett, Williamsport.
Towers, William H., Philadelphia.
Touzand, Monsieur J., Chateau Ray.
Tripp, Ira, Scranton.
Trump, Edward D., Jersey Shore.
Twaddell, L. H., Philadelphia.
Tyson, Carrol S., Norristown.

Updegraff, A., Wilkes-Barre.
Updegraff, Thomas, Newberry.
Updegraff, Daniel, Newberry.
Updegraff, Derrick, Newberry.
Urgnehart, John, Wilkes-Barre.
Unger, John G., Harrisburg.

Van Buskirk, S., Williamsport.
Vandyke, James, Northumberland.
Van Leer, Isaac, Wallace, Chester co.
Vanscoy, Daniel, Wyoming.
Vanvoorhis, H. B., Pittsburgh.
Vanvorce, John, Williamsport.
Vollmer, Charles F., Philadelphia.
Vonges, James C., Philadelphia.

Wagner, Louis, Philadelphia.
Waggoner, John A., Harrisburg.
Wait, B., Williamsport.
Walker, George, Montrose.
Walker, R. J. C., Williamsport.
Walters, Townsend, West Chester.
Walter, D. J., Bloomsburg.
Wallace, W. W., Pittsburgh.
Wallower, John, Harrisburg.
Wanamaker, William H., Philadelphia.
Washington, W. P., Shamokin.
Waterman, Joseph, Philadelphia.
Waterman, Albert G., Philadelphia.
Watts, Frederick, Carlisle.
Watson, Joanna, Philadelphia.
Watson, Oliver, Williamsport.
Watson, H. W., Williamsport.
Weaver, H. A., Philadelphia.
Weaver, M. B., Williamsport.
Weikheiser, Enos, Easton.
Welsh, John, Philadelphia.
Welsh, Samuel, Philadelphia.
Welsh, J. Lowber, Philadelphia.
Welch, Benjamin G., Hughesville.
Welch, Benjamin G., Hughesville.
Wescott, Thomas S., Ashland.
Wetz, Thomas H., Norristown.
Whitman, Thomas J., Philadelphia.
Whitman, Horace F., Philadelphia.
White, John, Williamsport.
Why, John, Jr., Pittsburgh.
Wible, William, Gettysburg.
Williams, Sites, Wilkes-Barre.
Williams, E. C., Harrisburg.
Wilhelm, A., York.
Wilhelm, J. Schall, York.
Wilson, D. Y., Green Tree, Chester co.
Wilson, S. L., Philadelphia.
Wingard, Samuel C., Williamsport.
Wolf, William, Harrisburg.
Wolf, Peter, Williamsport.
Wolfinger, Levi, Harrisburg.
Wood, James, Williamsport.
Wood, Robert, Philadelphia.
Wood, Thomas, Penningtonville.
Woodhaus, Samuel, Plymouth.
Woodward, John V., Williamsport.
Wright, Joshua, Washington co.

Yeager, Joseph, Philadelphia.
Yeaton, William H., Philadelphia.
Young, Alexander, Philadelphia.
Young, William, Easton.
Young, James, Middletown.
Young, Hiram, York.
Young, John, Jr., Ewing Mills, Allegheny co.
Young, A. P., Millville, Columbia co.
Youngman, George W., Williamsport.

Zerbe, Cyrus, Harrisburg.
Zeigler, John H., Harrisburg.
Zimmerman, A. M., Harrisburg.
Zimmerman, F., Williamsport.

AN ACT

To incorporate the Pennsylvania State Agricultural Society.

Incorporators.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same*, That George W. Woodward, James Irvin, E. A. Thompson, Frederick Watts, T. J. Bingham and others, who have subscribed the constitution lately adopted by a convention assembled at Harrisburg to improve the condition of agriculture, horticulture and the household arts, be and they are hereby created a body politic and corporate in law by the name of "The Pennsylvania State Agricultural Society," and by that name shall have perpetual succession, and have capacity to sue and be sued, and may have a common seal, which at their pleasure may alter or renew. They may take, by gift, grant, devise, bequest or otherwise, lands and tenements, goods and chattels necessary for all the purposes for which the Society was instituted: *Provided*, The annual income therefrom shall not exceed ten thousand dollars, independent of annual contributions by members, and the same to convey, lay out, apply and dispose of for the benefit of the said Society as they under their charter and by-laws may direct.

Title.

Corporate powers.

Annual income.

Disposal of same.

By-laws.

SECTION 2. That the members of the said corporation shall have power to make and enforce such constitution and by-laws as may be necessary for the good government of the Society, and the same from time to time to revoke, alter and amend, as they may think proper: *Provided*, That the same shall not be inconsistent with the constitution and laws of this State.

State appropriation

SECTION 3. That the sum of two thousand dollars, out of any money in the treasury not otherwise appropriated, be and the same is hereby appropriated to the said Society; and annually hereafter a sum of equal amount to that paid by the members thereof into its treasury, affidavit of which fact, and the amount so raised by the treasurer of the Society, being first filed with the State Treasurer: *Provided*, Such sum shall not exceed two thousand dollars in any one year.

County agricultural societies.

SECTION 4. That when any number of individuals shall organize themselves into an agricultural or horticultural society, or any agricultural or horticultural society now organized within any of the counties of this Commonwealth shall have adopted a constitution and by-laws for their government, elected their officers, and raised annually, by the voluntary contribution of its members, any sum of money which shall have been actually paid into their treasury for the purpose of being disbursed for the promotion of agricultural knowledge and improvement,

and that fact be attested by the affidavit of their president and treasurer, filed with the commissioners of the county, the said county society shall be entitled to receive annually a like sum from the treasurer of their said county: *Provided*, That said annual payment out of the county funds shall not exceed one hundred dollars: *Provided further*, That but one such society in any county shall be entitled to receive such appropriation in any one year under this act. County appropriation. Limitations.

SECTION 5. That the President of the Pennsylvania State Agricultural Society, who shall receive or expend any of the moneys hereby appropriated, shall annually, on the first Monday of January, transmit to the Governor of the Commonwealth a detailed account of the expenditure of all the moneys which shall come into his hands under this act, and stating to whom and for what pur pose paid; and a copy of the said report shall be transmitted to the Legislature at as early a day as practicable, and the original shall be filed in the office of the Secretary of the Commonwealth. And the presidents of the several county agricultural societies shall annually transmit, in the month of December, to the Executive Committee of the Pennsylvania State Agricultural Society, all such reports or returns as they are required to demand and receive from applicants for premiums, together with an abstract of their proceedings during the year. This act shall at all times be within the power of the Legislature to modify, alter or repeal the same. Duty of president. Duty of presidents of county agricultural societies.

JOHN CESSNA,
Speaker of the House of Representatives.
BENJAMIN MATTHIAS,
Speaker of the Senate.

APPROVED: The twenty-ninth day of March, Anno Domini one thousand eight hundred and fifty-one.

WM. F. JOHNSTON.

CONSTITUTION AND BY-LAWS

OF THE

PENNSYLVANIA STATE AGRICULTURAL SOCIETY

Title. Objects.

The name of the Society shall be the PENNSYLVANIA STATE AGRICULTURAL SOCIETY. The objects of this Society are to foster and improve agriculture, horticulture, and the domestic and household arts.

Who are Members.

Members.

SECTION 1. The Society shall consist of all such persons as shall pay to the Treasurer not less than two dollars, and annually thereafter, not less than two dollars; and also, of honorary and corresponding members, the names of the members to be recorded by the Secretary.

The officers of county agricultural societies in this State, or delegations therefrom, shall be members *ex-officio* of this Society.

Life Members.

The payment of fifty dollars shall constitute life membership, and exempt the members so contributing from all annual payments.

Officers.

Officers.

SECTION 2. The officers of this Society shall be a President, Vice President from each congressional district, three-fourths of whom shall be practical agriculturists or horticulturists, a Treasurer, a Corresponding Secretary, a Recording Secretary, a Librarian, an Agricultural Chemist and Geologist, and such assistants as the Society may find essential to the transaction of its business; an Executive Committee, consisting of the above-named officers, five additional members, with the ex-Presidents of the Society, all of whom shall be elected at the annual meeting in January by the qualified members of the Society.

When elected.

Of the President.

President's duties.

SECTION 3. The President shall have a general superintendence of all the affairs of the Society.

First Vice President.

That at the annual election of this Society there shall be elected from one of the number of Vice Presidents one of said officers to act as first Vice President, whose duty it shall be to act as President in case of absence or the death of the President.

Election of and duties of First Vice President.

Ex-Presidents.

That whenever the number of ex-Presidents exceeds five (5), the name receiving the lowest number of votes shall be the one dropped from the list of officers.

Ex-Presidents.

Of the Vice Presidents.

It shall be the duty of the Vice Presidents to take charge of the affairs of the association in their several districts; to advance all its objects, to call upon farmers to report as to the condition of agriculture in their neighborhood; to ask for information as to the modes of cultivation adopted by different farmers; and, as far as in their power, to make known the resources of their districts, the nature of its soil, its geological character, and all such matter as may interest farmers in every part of the State.

Duties of Vice Presidents.

Treasurer.

The Treasurer shall keep an account of all moneys paid into his hand, and shall pay bills when audited and approved by the Executive Committee. Each order for payment must be signed by the President or chairman of the Executive Committee.

Duties of Treasurer

Corresponding Secretary.

The duty of this officer shall be to invite a correspondence with all persons interested in agriculture, whether in the State of Pennsylvania or elsewhere, but especially with our consuls in foreign countries, that new seeds, vegetables, or live stock may be introduced, and their fitness for cultivation and propagation in our climate be tested. At each stated meeting of the Society he shall read his correspondence, which shall, either the whole, or such parts as may be selected by the Society, form a portion of the transactions. He shall also correspond with the President or other officers of each State society in the United States, at least twice in the year, for the purposes of combined and mutual action, and to be informed of the results and progress of each other's efforts; also, to invite mechanics to forward models or implements for examination or trial.

Duties of Corresponding Secretary.

Recording Secretary.

The Recording Secretary shall keep the minutes of the Society and of the Executive Committee. At the close of each year he shall prepare for publication such

Duties of Recording Secretary.

Powers of Recording Secretary.

The Recording Secretary shall have power to approve of such bills and contracts as he is authorized to make, and the Treasurer shall pay the same.

Librarian.

Duties of Librarian.

The Librarian shall take charge of all books, pamphlets, &c., belonging to the Society, and shall act as curator to preserve seeds, implements, or whatever property the Society may possess.

Vacancies—how filled.

In case of the death of any of the officers of this Society, the President shall have power to fill the vacancy by appointment until the next annual meeting of the Society.

Executive Committee and Quorum.

Duties of Executive Committee.

The Executive Committee shall transact the business of the Society generally; shall superintend and direct the publication of such of the reports and transactions as they may deem proper, and shall designate the time and places for annual exhibitions, regulate the expenditures, examine all accounts, and keep such general charge of the affairs of the Society as may best promote its interests.

Quorum of Executive Committee.

They shall select their own chairman, and meet quarterly, and at any other time when convened by the President; five members shall form a quorum.

Special meetings of Society.

They shall call special meetings of the Society when necessary.

Annual Meeting of the Society and Quorum.

Annual meeting of Society—when held. Mode of electing officers. General and special meetings.

SECTION 4. The Society shall meet annnally, on the third Wednesday of January, at Harrisburg, when all the officers of the Society, not otherwise appointed, shall be elected by ballot for the ensuing year, and until another election. The polls shall be opened at 10 A. M. and close at 12 o'clock M., when the result of the election shall be announced. They shall also hold a general meeting at the time of the annual exhibition, and special meetings whenever convoked by the Executive Committee.

Quorum of Society.

Fifteen members shall form a quorum for the transaction of business, but no member in arrears shall be entitled to the privileges of the Society.

Qualifications of Voters.

Qualifications of voters.

SECTION 5. No annual member hereafter shall be entitled to vote for the election of officers of the Pennsylvania State Agricultural Society unless he shall have been a member of the previous State fair, and in default of a State fair, then three months' previous membership shall be necessary.

SECTION 6. No one shall be eligible to office hereafter who has not obtained a right to vote under section five. Eligibility.

Alterations.

SECTION 7. This Constitution may be altered or amended at the annual meetings in January, by a vote of two-thirds of the members in attendance. Alterations and amendments Vote necessary to.

All amendments to the Constitution, to be voted upon at the annual meeting of the Society in January, must be submitted to the meeting of the Executive Committee in September preceding said annual meeting. Must be submitted to Executive Committee.

TRANSACTIONS OF THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY, 1887.

HARRISBURG, *January 18, 1887—7.30 o'clock p. m.*

The meeting of the Executive Committee was called to order by President Wilhelm. The following members were present: Messrs. Paxson, Chambers, Branson, A. Rutherford, Barto, Holstein, J. B. Rutherford, Taylor, Taggart, Haldeman, Ziegler, Miller, Tripp, Kennedy, McConkey and Seiler.

The minutes of the former meeting were read and, on motion, approved. Letters from the following officers, Messrs. Mackey, Shaner, McDowell. Kirkpatrick, Neiman and Speer, regretting their inability to be present, were then read.

Mr. Branson submitted the following report on experimental seed planting:

OUR CEREALS.

Fifth annual report of the Chester County Committee, appointed by the State Agricultural Society to conduct experimental plots of the various cereals best adapted to our soil and climate:

Mr. President and Gentlemen of the State Agricultural Society:

Your committee appointed to conduct plots of cereals, &c., would most respectfully submit this, the fifth annual report, as the result of a careful series of experiments representing many the most approved sorts especially adapted to our climate. The varieties of

Wheat

were selected for the year 1886, namely: Plot No. 1, Russian wheat; No. 2, Hybrid Mediterranean; No. 3, Landreth wheat; No. 4, Martin's Amber; No. 5, Deitz Longberry; No. 6, Golden Prolific, all of which were drilled September 20, 1886, with an improved Chalfant drill. Conditions as to soil, fertilizing, &c., about the same. Suffice to say, that early spring and almost up to harvest time the rainfall was greater than has been experienced for many years, making all the conditions of growth so favorable that the enormous growth of straw prematurely lodging had a serious tendency to lessen the bushels per acre, both wheat and oats.

Of the Russian wheat we harvested on plot 1 thirty-seven bushels per acre. Plot No. 2, Hybrid Mediterranean, thirty bushels ten pounds. No. 3, Landreth wheat, thirty-one bushels thirty-two pounds. No. 4, Martin's Amber, thirty-four bushels nine pounds. No. 5, Deitz Long Berry, twenty-nine bushels seventeen pounds. No. 6, Golden Prolific, twenty-eight bushels twenty-one pounds, all cut and harvested in good condition. Not only a liberal dressing of barnyard manure was applied, but in addition three hundred pounds of a high grade commercial fertilizer to the acre. The showing in this test seemed to be in favor of the Russian wheat, not only for its producing qualities, but for stiffness of straw, whilst the Hybrid Mediterranean nearer approached the Old Mediterranean as for quality of kernels. The

Deitz Long Berry is also of a good grade for roller process of manufacturing flour. Altogether the above sorts proved entirely a success, the difference in yield and quality being slight, as above stated. The Russian wheat, however, made the best showing, all of which was harvested in good condition.

Oats.

Not having any new special variety for our plots last spring we sowed our entire enclosure—twelve acres—with the Welcome. These oats have given us such results that we have discarded all other varieties. Our yield of bushels the acre for 1886 falls short of the yield of 1885, it being for that year ninety-two bushels twenty-three pounds to the acre.

As we have previously stated, the immense growth of straw lessened the bushels of seed, much of it standing from six to seven feet high. Seven hundred bushels, the crop of 1885, was sold in a home market for one dollar per bushel.

Corn.

This crop upon our various plots gives us good results, especially our own particular variety, a mixed corn with large cob and deep grain.

Preparation of the Ground.

The field timothy sod had a light dressing with stable manure in the late fall and early spring, plowed down during the months of March and April, thoroughly pulverized and drilled in May 10 and 11, together with three hundred pounds the acre for commercial fertilizer, the grains spaced thirteen inches apart in the row, and distant three and one-half feet between rows. Yield, ninety-five bushels the acre of solid marketable corn, samples of which will accompany this report.

Our experiments for the year 1886 have more than rewarded us for the labor bestowed, aside from the small remuneration for our surplus products in the market. We have the satisfaction of being able from our annual experiments to sow and plant intelligently such seeds as seem best adapted to our soil and climate.

All of which is respectfully submitted.

DAVID H. BRANSON,
Committee.

JANUARY 18, 1887

Mr. Paxson presented to this committee proposed amendments to the Constitution to be submitted for the Society's action to-morrow. The same having been reported to a joint meeting of the Executive Committee and committee of arrangements in Philadelphia, October 9th, 1886.

The same were read for the information of this body.

A circular letter addressed to the officers and members of this Society requesting them to favorably influence their Senators and Representatives for an appropriation to aid this Society, was read and ordered to be inserted in the minutes as follows:

OFFICE OF THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY,
HARRISBURG, PA., *December 29th, 1886.*

DEAR SIR: The Pennsylvania State Agricultural Society, of which you are a member, has expended a large sum of money in the erection of buildings on its grounds at Philadelphia, which was done in obedience to a general public demand, by selecting a convenient location for a term of years and of easy access, to afford the farmers the best facilities for the display of stock and other agricultural products.

The Society although chartered by an act of the Pennsylvania Legislature, is not a stock company, it has no stockholders, nor salaried officers, except the Secretaries and Treasurer. All its net profits are expended in the payment of premiums and to promote the broad interests of agriculture. It has done much for the promotion of the agricultural interests in Pennsylvania. It has paid about $200,000 in cash premiums. It expended $10,000 at the International Wool Exhibition in 1880. It voluntarily contributed $14,000 to the Pennsylvania State Agricultural College, and it has expended upward of $100,000 in the erection of buildings, etc., on its grounds at Philadelphia; consequently it has incurred a large debt. To relieve it from its present financial embarrassment, a bill will be presented at the meeting of the Legislature in January next for an appropriation for the relief of the Society. I therefore appeal to you to exert your personal influence with the Representatives from your district, to the Legislature of Pennsylvania, in behalf of the Society to support the bill for an appropriation when presented for their consideration.

Yours truly,

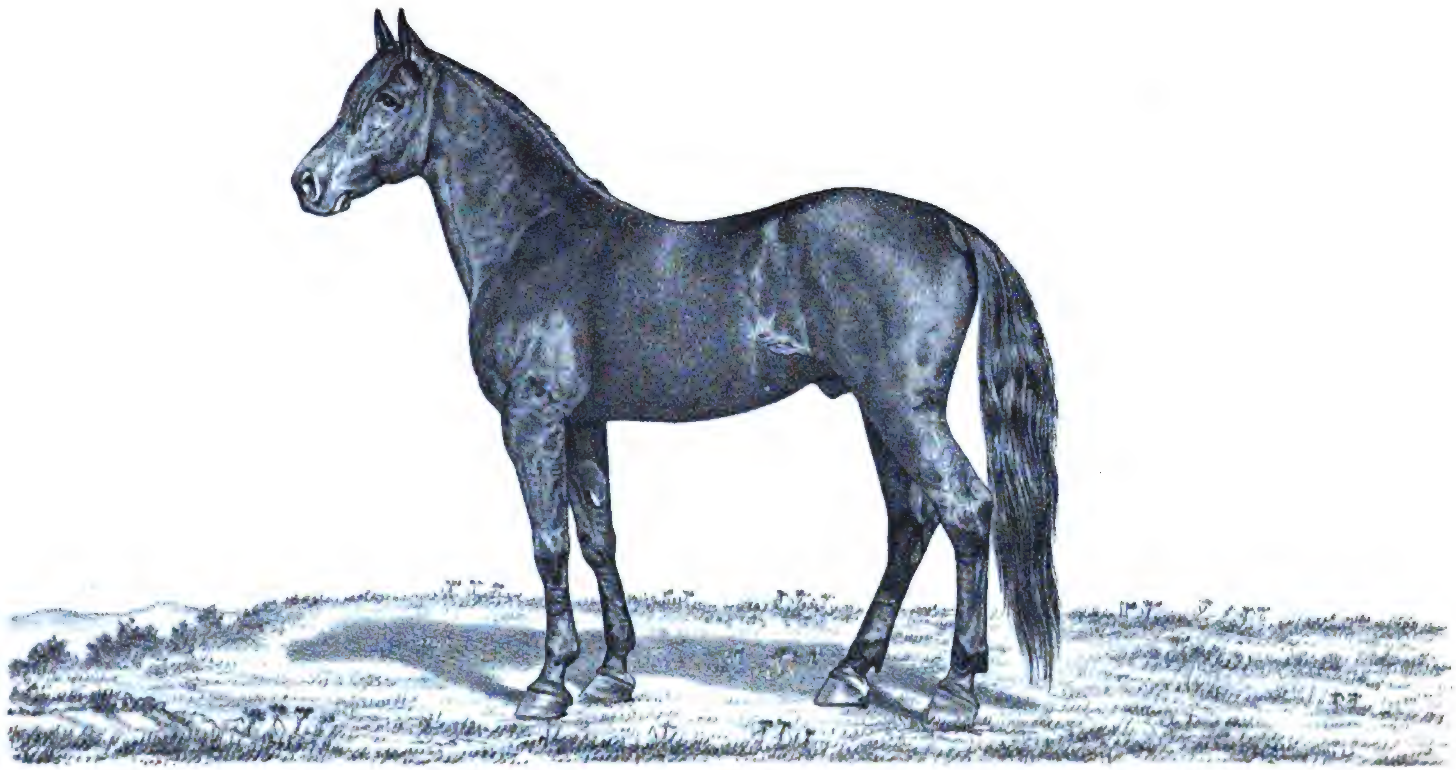
A. WILHELM, *President.*

President Wilhelm submitted a statement showing the financial condition of the society and explained to this committee the amount of labor performed by the committee of arrangements in the past two years. In 1885 an agreement was made with the Society of Arts of Philadelphia by which the main building and annexes were transferred to that organization, and an exhibition of three weeks, open day and night, was held, which required this Society to expend a large sum of money. The result of this was most unfortunate. A clause in the agreement required it to be submitted to the annual meeting of the Society in 1886 for confirmation. This was not agreed to and the agreement then became null and void. The exhibition made money the first and second weeks, but the last week was a failure, and all money made previously was lost. The entire indebtedness is now $77,711 47.

The question of securing aid from the Legislature was then discussed at length and the secretary was directed to send circular letters to the officers, and request them to forward them to their representatives, asking for an appropriation of $50,000.

On motion adjourned.

D. W. SEILER, *Secretary.*



HEPTAGON.

SIRE, HAROLD. DAM, HERMOSA. OWNED BY W. H. RICHTER.
BENVENNE STOOK FARM, DAUPHIN CO., PA.

SOCIETY MEETING.

HARRISBURG, PA., Wednesday, *January 19, 1887.*

At ten o'clock A. M., the Pennsylvania State Agricultural Society convened in their office in the *Telegraph* building.

Mr. Seiler moved that Mr. Bergner act as chairman of the meeting, which was unanimously agreed to.

Mr. Bergner, on taking the chair, said: I thank you for the partiality which you have shown me on this occasion, for there are others here who, I think, are better able to perform the duties required. I will now simply call the meeting to order, and say that we are ready to proceed with the business.

Mr. D. H. Branson was appointed judge, and Tobias Barto and William Taylor tellers to conduct the annual election for officers.

A motion that General Louis Wagner, J. T. Stavely and W. W. Holstein act as a committee to audit the accounts of the treasurer was made. General Wagner declined to act, when S. A. Hummel was substituted, and the motion agreed to.

The ballot was had and continued until twelve o'clock M., when it was announced closed. The judge and tellers announced the following result:

President.

A. Wilhelm,	44	votes.

First Vice President.

Wm. M. Singerly,	10	"
J. A. Paxson,	33	"

Vice Presidents.

1.	George Blight,	42	"
2.	L. H. Twaddell,	42	"
3.	Joseph E. Gillingham,	30	"
	Thomas H. Downing,	12	"
4.	Wm. M. Singerly,	44	"
5.	G. Handy Smith,	44	"
6.	David H. Branson,	44	"
7.	William H. Holstein,	44	"
8.	Tobias Barto,	44	"
9.	B. J. McGrann,	44	"
10.	Daniel H. Neiman,	44	"
11.	D. J. Waller.	44	"
12.	Ira Tripp,	44	"
13.	J. S. Keller,	44	"
14.	Gabriel Hiester,	44	"
15.	Joseph Piollet,	44	"
16.	R. J. C. Walker,	44	"
17.	John A. Lemon,	44	"
18.	John S. Miller,	44	"

19. Chauncey F. Black,	31	votes.
20. Hiram Young,	5	"
21. L. A. Mackey,	44	"
22. George Rhey,	44	"
23. F. Y. Clopper,	44	"
24. W. W. Speer,	44	"
25. John McDowell.	44	"
26. J. S. McKean,	44	"
27. J. D. Kirkpatrick,	44	"
28. J. C. Thornton,	44	"

At Large.

J. A. Paxson,	42	votes.

Additional Members—Executive Committee.

W. F. Rutherford,	44	votes.
William Taylor,	44	"
John H. Ziegler,	44	"
Jefferson Shaner,	44	"
Cyrus Chambers, Jr.,	43	"

Ex-Presidents, Members of the Board.

D. Taggart,	44	votes.
Frederick Watts,	44	"
Jacob S. Haldeman,	44	"
James Miles,	44	"

Corresponding Secretary.

Elbridge McConkey,	41	votes.

Recording Secretary.

D. W. Seiler,	44	votes.

Treasurer.

John J. Nissley,	42	votes

Chemist and Geologist.

A. L. Kennedy,	44	votes.

Librarian.

William H. Egle,	44	votes.

Mr. PAXSON. Mr. Chairman and gentlemen of the Society: I would be glad to have your attention for a moment. If, in asking that attention, I shall be considered as claiming time that more properly could be devoted to some other purpose, and that I am out of place in doing so, I shall take it as an act of courtesy if some one will say so. It has been my pleasure to have been associated for quite a while with this Society. In order to secure a little more harmonious working and simplicity in the working of its machinery, some weeks ago—possibly six months—it was deemed advisable that certain changes be made in the by-laws, and a committee was appointed. I believe that committee is all here. That committee, at the meeting in September, submitted a rough draft of the proposed changes. That meeting adjourned from time to time, and has continued as an adjourned meeting to hear

of those changes. It was directed to be here at this meeting. It was hoped, before any action should be taken toward fixing the policy of the Society for the coming year, that this association would take up these proposed changes and make some disposition of them. I find, however, that from some cause, rather unusual haste is being manifested by some of the members of the Society. This is evident from their great anxiety to start in with the annual election of the officers. Do not for one moment suppose that I have any feeling in the matter, or that I have any ambition in this connection, for, gentlemen, I have not. I would be very glad to relinquish and be relieved if that is the interest of the Society. I think that those by-laws should be read and action taken upon them, and then the election held after their adoption. I want to say, on behalf of a few gentlemen who are here, that it just happens that I have some knowledge and some idea on whom the burden of this work has fallen for years, because of our location near the seat of active operations. But we all know very well on whom a large portion of the onerous work has fallen, and I therefore claim, on behalf of those who are here, that those gentlemen should be relieved from the burden of this work, or at least have a fair opportunity to be heard in the formation of the policy of the Society. I hope that some one will ask that the proceedings be reconsidered, that this question be taken up and disposed of, if that is in order.

Mr. SEILER. A committee was appointed to prepare some amendments to the constitution, and those amendments were submitted to the committee on October 9. It appears that the copy I have in my hand is not the same as the copy in the hands of the committee. However, this copy was given to me by one of the committee, Mr. Downing, and was endorsed October 9 at the meeting of the committee. I read it over last year when it was handed to me, and I saw that that was the result of the first meeting of the committee. They had three or four meetings. How these amendments as now presented are handed in as the final result, I do not know.

Chairman BERGNER. The discussion so far has been going on without a motion whatever before the body. A motion is now made by the gentleman to my left, that the meeting now proceed to consider the report of the committee who have had under consideration the preparation of amendments to the constitution and by-laws of this society. Is that motion seconded?

(It was seconded)

Chairman BERGNER. The question before the house is, shall this meeting now proceed to the consideration of certain amendments to the constitution and by-laws?

Upon that the question was called for, and after being put, it was agreed to.

Mr. WILHELM. Are the members of the association aware that it is owing $80,000, and that there is not a five-cent piece in the treasury to pay it? Is this association prepared to meet it? Do these gentlemen imagine that they have accomplished a great thing by allowing this debt of $80,000 to hang over the Society? Do the gentlemen understand this? A year ago information was brought to us that $23,000 of the debt of the Society was paid. An exhibition has since been held, which paid its expenses and a little over, after the utmost effort.

Mr. MUMMA. I came in here somewhat ignorant of what was expected of me this morning, not entirely acquainted with the opera-

tions of the State Agricultural Society. There are those present—I may say it without showing a want of modesty—who were present in the old capitol building when the first speech was made in the favor of the organization of the State Agricultural Society. I had then an ample farm. In that particular speech I got well warmed up before I was done. I believe it was the most successful attempt at a speech I ever made. I took an active part in the Society for years. We went on with the Society, and we all attended and gave our time all the week, or while the exhibition was in operation. We made, in a very short time, quite a large sum of money, which we paid over to the farmers. We raised a large fund; we had plenty of money, and the State gave us an appropriation. The Society was on a most excellent basis. Within five years it has been run into debt to the sum of almost a hundred thousand dollars. Now I think the quicker we sell out the better. How can it get along without being wound up, in this condition? Why it is so, I do not know.

The question is now as to the consideration of the by-laws. I must confess I do not know what bearing they have on the proposition to extricate the Society from its difficulties. I can hardly see how we can understand exactly the way to vote on the subject without knowing what they propose to do. There seems to be a fear on the part of our friends here. With the experience I have had in public legislation I consider it safe to vote no. I think the better way would be to call a halt somewhere and start again—here in Harrisburg, where we started first, or Pittsburgh, or somewhere else. We held a fair at Pittsburgh, on the John Powell estate, when there was a farm there. That kind of work might have been contined, though we were serving without pay, the most of us. The result was that what little money we took in at the gate, we took it ourselves.

A MEMBER. In reply to the gentlemen, I would say my motion was that this committee, notwithstanding this election, permit the by-laws to be read before it. In regard to the proposition about letting this thing go, we cannot live under it. We in Philadelphia have certain business standing, and if the State Agricultural Society is sold out to-day, it will reflect on every member of its committee of arrangements and upon his private business. That is a matter of very serious consideration.

Mr. DAVID H. BRANSON. I had not intended saying a word on this subject, but there has been an assertion made to-day that I really cannot reconcile myself to without giving expression. In the first place upon my left is a gentleman from Philadelphia who says he has not had a former acquaintance altogether with the transactions of this Society. In electing officers he also says they probably will not be interested in attending the Agricultural Society or giving it their attention and support. Now, I have great faith in every man who is on that ticket, representing every agricultural society in the State of Pennsylvania. If he is not able to manage and control the State Agricultural Society can we transfer it, or recommend that it be conducted in Philadelphia or Pittsburgh by men who are not agriculturists. This Society should be an agricultural society. If a man who is engaged in an agricultural society is not able to conduct it, I suppose that man ought not be engaged. Now from the showing that we have, the $80,000 in Philadelphia is not all lost. The finest exhibition buildings are there to-day of any State in the Union. Those buildings are there, though not entirely paid for.

The Pennsylvania State Agricultural Society is asking the Legislature for the trifling sum of $50,000. Since the inception of the State Agricultural Society it has paid over $250,000 in support of agricultural improvements. The Agricultural Society has done great good, it is doing great good to-day, and I have abiding faith in that ticket.

Mr. PAXSON. I do not wish the gentleman who has just spoken to labor under the delusion that so far as I am concerned I have the slightest share in the running of this Society; or the slightest desire to do so. I am sorry that I ever became interested in it, because there has been no interest in it. It has been a source of labor, a source of expense, and a source of annoyance. Let me repeat briefly to some extent what I understand—for I do not know anything about this ticket which is to be the Moses that is to lead this Society through the wilderness. I will repeat simply what I have said before. Judging the future from the past, a very large proportion of the gentlemen upon this list who are here now will never be near the Society. They never have been, and never will be unless the future is entirely different from the past. They may be very excellent farmers, all of them; but they certainly do not attempt to run this Pennsylvania State Agricultural Society. There are a number of lawyers there—no reflection on the lawyers. It is amusing to me to have them designated as those upon whom the salvation of the Society depends. My connection with it only begins a year back, when we were told that $20,000 would save the Society from all embarrassment. The later reports of the Society show that it now owes $80,000. They have nothing to show for it but frame buildings upon the grounds. They will be sold for old lumber. So far as the good old times are concerned, to which my friend Judge Mumma referred, it is a pity that the Society attempted to do what they did attempt to do. It is simply a question of judgment. Don't think it requires any great knowledge of farming to enable you to tell which way to go to get into an indebtedness of $80,000 I wouldn't take the directorship of this Society at present, not if you paid me a big salary. Therefore, it is not the desire to run anybody out or to run anybody else in that governs me, but simply a knowledge and conviction. You cannot get away from it.

Mr. WILHELM. Now, in regard to the ticket presented here this morning, I have served the Society as faithfully as I knew how for three years. I am satisfied that I have visited this office more than fifty times each year. There are members on this ticket who have never seen the Society, and never will. Here are by-laws submitted by a committee duly appointed. In accordance with our present by-laws we should take this question up and have it considered. But you have not even called for the reading of the report of your committee. How can you vote understandingly unless you have those proposed by-laws read?

The by-laws were read by Mr. Paxson.

Mr. PARSONS. I would suggest that that report be printed, and a copy be furnished to all the members upon the records, and that the proceedings be deferred until they can see it and read it. The report of that committee ought to be furnished, at least, so that all the members can take it and read it at their leisure. We want to know the results that will come from that which we are going to vote upon. I think it is fair that all these very important matters should have the consideration of all the members.

The CHAIRMAN (Mr. Bergner). This discussion is all informal. We should have a motion.

Mr. PAXSON. In a general way, I do not see that the suggestions of Mr. Parsons are out of order, for these proposed by-laws submitted here can, as I understand, now be discussed. It is a pretty good suggestion to have them printed in slip form, and sent to the members. Whatever is done with them, or whatever is not done, I want to have my say for the last time on something which I have discovered here to exist, and of which I had no knowledge in any shape or form. In 1879, as president of the International Exhibition Company, I had during six months several interviews with the members of this Society, who were strangers to me then, and, as the result of those interviews, you held your fairs in the main building at Philadelphia. After that I find I have gradually drifted into helping to turn the grindstone. I want to say here that the difficulty has been at all times financial. So far as my knowledge goes, the difficulty has been to get out of debt. What I object to here, and I don't want anybody to misunderstand me, is being held responsible for the execution of a policy in which I am not allowed to have a voice. That is what I mean, gentlemen. I object to being held responsible as a member of this executive committee—and I have given three and four months of the hardest sort of work upon it—I do object, I say, to being held responsible and yet be forced out of any sort of voice in the formulating of the policy of the Society. I see a disposition of that character right here in this meeting now. Gentlemen, business is business, and there should be no sentiment in this. But there seems to be a disposition here to take the whole management of this matter, and the form of the policy that should control and govern, out of the hands of those desirous of forming it definitely—from those who would have it carried out—to vote it down, walk away, and then expect the same committee to report successful results. I do not think it is right, manly or fair. Now, gentlemen, will you not do one thing to oblige me—you who have persisted that this policy should not be—will not some one of you, the best friend I have in this whole business, offer a resolution that I be relieved from any further connection with the committee of arrangements? I want you to do that, to save me the trouble of writing it myself. It is not fair or right to ask me to serve longer under the circumstances. From the early part of July, Mr. President Wilhelm, Mr. Seiler, Mr. Downing, Gen. Wagner, Mr. Shaner, of Chester county, Mr. Palmer, Mr. Cyrus Chambers and Mr. Hooper, week after week—one, two and three meetings every week—every week consuming a whole day and a half; and, when the fair is opened, sometimes three weeks, the whole of our time devoted to this business necessarily, and not one farthing of compensation is asked, expected or wanted. Now, these are the people who have had to carry out your wishes, and as against them we leave this at the instigation of somebody, something that you do not properly appreciate the value of. I know you do not understand it—this attack at the instigation of some one. You are certainly here to do that which is fair. You have probably said—and if I make a mistake I hope you will correct me, members of the executive committe, or vice presidents, as you may please, or gentlemen; you who are here as the result of a little more abuse, all you that should have been appointed as the board of managers—you have probably said to them, "Gentlemen, we will discontinue your efforts." I do not know whether you mean that exactly or not, but

take warning in time. That is exactly what has been done. If I misunderstand it, that is one thing. I would like to know how you look at it yourselves.

I am glad Mr. Parsons has made the remarks he has. As a business man of Philadelphia, I can say this: There are very few who will put their shoulder to the wheel. All this interest that has been taken by these gentlemen has only been the loss of much valuable time. I was so disgusted with myself in regard to the condition of affairs that I positively made up my mind not to have anything to do with it. I had my engagements last evening that I abandoned for the purpose of being here, hoping that some action would be taken.

The Chairman. The question before the meeting, is the amendment upon the pending motion, offered by Mr. Pearsons, that this report of the committee be furnished in slip form, and a copy be presented each member of the Society.

Mr. Wilhelm. I think it is due the members of the Society who have not heard the report of the exhibition of 1885, also of the exhibition of 1886. and who wish to act more understandingly on the subject of the policy of this Association, that they know the desire of the members of the Society. Those reports are here. If they are called for, they will be read.

Now, it is hardly worth while to detain you gentlemen; but there has been so much said relative to this forming of the policy of this Society that perhaps something should be added. It is very important, at this late day, to rid ourselves of this debt of $80,000. Now, it occurs to me that you are getting entirely too apprehensive. The Board of Managers have seen during the last year the necessity of a change in your by-laws, which is not the "fundamental law," as it is called, for that is the creator of the Society; and the suggestion of my friend, Mr. Parsons, is very good, that it may be proper to have them printed. There is nothing inconsistent, I think you will bear me out, in adjourning until to-morrow. I would like every member of this Society to vote understandingly on this subject. Every member wants to vote. If the chair will entertain the motion that I will make at the proper time, that the meeting do now adjourn until to-morrow, these by-laws can be printed and acted upon by that time. As a lawyer, (referring to Mr. Bergner,) you will bear me out that with every corporation within this Commonwealth, if the election does not take place on the day designated by its by-laws, or by its fundamental law, the charter, the officers hold over until elected.

The Chairman, (Mr. Bergner.) The question is on the amendment offered by Mr. Parsons, that this report be printed in slip form, and a copy thereof be sent to each member of the Society.

Mr. Seiler. I would like Mr. Parsons to suggest when action shall be taken upon this question.

Mr. Parsons. As I understand the subject, I think it would be better to adjourn for one year. Since I made the motion, I comprehend matters a little different than I did before. If Mr. Wilhelm's motion is approved, let us have another session this afternoon. It will take but a very little time for the proposed by-laws to be written off.

Mr. Cyrus Chambers. I am not very good at prophesying, but my impression is that the postponement of the consideration of these by-laws for one year will be very inconsistent, as the Pennsylvania State Agricultural Society will quite likely be wiped out of existence by that time so far as material existence is concerned.

The CHAIRMAN. The question was on the amendment of Mr. Parsons, which has been withdrawn, and the question now pending is, Shall this Society proceed to the consideration of the proposed new by-laws offered by the Executive Committee through Mr. Paxson?

(The question having been withdrawn temporarily,)

It was moved and seconded that the meeting take a recess until 1 o'clock.

At 1 o'clock, P. M., the Society re-convened.

The CHAIRMAN. The pending question as to proceeding to the consideration of the amendments to the by-laws.

A MEMBER. Mr. Chairman, the recess was taken to give us an opportunity to put these by-laws into reasonable shape.

Mr. PAXSON. We have three copies of it.

It was moved and seconded that the by-laws be read section by section, which was unanimously agreed to,—the first copy to be placed in the hands of Mr. Parsons, the second in the hands of the Corresponding Secretary, and Mr. Paxson to have the third copy.

CONSTITUTION AND BY-LAWS OF THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY.

ARTICLE I—Name and Object.

The name of the Society shall be the Pennsylvania State Agricultural Society. The objects of this Society are to foster and improve agriculture, horticulture and the domestic and household arts.

ARTICLE II—Members.

SECTION 1. The Society shall consist of all such persons as shall pay to the Treasurer not less than five ($5) dollars membership fees, and annually thereafter not less than three ($3) dollars payable on or before the meeting of the Society in January, and also life, honorary and corresponding members.

SECTION 2. The payment of fifty ($50) dollars shall constitute life membership and exempt the members so contributing from all annual dues.

SECTION 3. The officers of the county agricultural societies in this State or delegates therefrom shall be members and officers of this society.

ARTICLE III.—Meetings.

SECTION 1. The Society shall meet annually on the third Monday of January at Harrisburg, to consider the annual report, elect officers and transact such business as may claim its attention.

SECTION 2. Fifteen members shall constitute a quorum for the transaction of business. The meeting shall convene a 12 o'clock noon. And the polls for the election of officers shall be open from 1 to 2 P. M.

SECTION 3. Special meetings may be called at the option of the President or shall be by him upon written request of seven members by giving ten (10) days' notice to each member.

ARTICLE IV.

SECTION 1. The officers of this Society shall be a president, a vice-president from each congressional district, three-fourths of whom

shall be practical agriculturists or horticulturists, a treasurer, a secretary, a librarian, a chemist and geologist and a board of managers, to consist of the president, first vice-president, five additional members, all of whom shall be elected by ballot at the annual meeting of the qualified members of the Society, and five additional members may be appointed by the president.

SECTION 2. All vacancies shall be filled by the president with the approval of the board of managers.

President.

SECTION 3. The president shall have a general superintendence of the affairs of the Society.

First Vice President.

SECTION 4. There shall be elected annually one of the vice-presidents to be vice president, whose duty it shall be to act as first vice president in case of the absence or death of that officer.

Vice Presidents.

SECTION 5. It shall be the duty of the vice presidents to take charge of the affairs of the Association in their respective districts; to advance all its objects; to call upon farmers to report as to the condition of agriculture in their neighborhood; to ask for information as to the modes of cultivation adopted by different farmers; and, as far as in their power, to make known the resources of their districts, the nature of its soil, its geological character, and all such matter as may interest farmers in every part of the State.

Treasurer.

SECTION 6. The treasurer shall receive and keep an account of all moneys paid on account of this Society, and shall pay bills when audited and approved by the board of managers, but only on orders signed by the president and attested by the secretary. All fines shall be deposited in such depository as the board of managers shall approve and in his name as treasurer of the Society. He shall keep correct books of account of the financial transactions of the Society and present an abstract thereof at each stated meeting of the board of managers, and a detailed annual report with proper balance sheet at the annual meeting of the society. He must give a bond of $5,000, with one or more securities, approved by the board of managers.

Secretary.

SECTION 7. The secretary shall keep the minutes of the Society and of its standing committees. He shall keep separate registers of the annual, life, honorary and corresponding members, giving name, residence and date of election. No name to be placed or kept on these registers unless all the fees and dues are paid as provided. He shall notify all members of the meetings of the Society, he shall invite correspondence with persons interested in agriculture in the State of Pennsylvania or elsewhere, and especially with our consuls in foreign countries, so that new seeds, vegetables, or live stock may be introduced and their fitness for cultivation in our climate be tested. At each stated meeting of the Society he shall read his correspondence, which shall either, the whole, or such parts as shall be selected by the Society, form a portion of the transactions. He shall also correspond with the

president or officers of State societies in the United States in order to secure combined and mutual action, and to be informed of the results and progress of each other's efforts. At the close of each year he shall prepare for publication such parts of the minutes and transactions of the Society as may be designated, and discharge such other duties as the Society or its standing committee may require.

Librarian.

SECTION 8. The librarian shall take charge of all books and pamphlets belonging to the Society, and discharge such other duties as ordinarily pertain to his office.

ARTICLE V.—Board of Managers.

SECTION 1. The board of managers shall have general supervision of the affairs of the Society. They shall have charge of the exhibition grounds and buildings at all times, and make all arrangements for the exhibition of the Society, appoint all officers and employés necessary for their proper managment, define their duties and fix their compensation: *Provided*, That the secretary and treasurer shall have power to appoint all their assistants subject to the approval of the board of managers. They shall superintend and direct the publication of such of the reports and transactions as they may see proper, and shall designate the time and place for the annual exhibition. They shall arrange their time and place for meeting and may be convened at any time by the president. They shall make a written report of their transactions annually to the Society.

SECTION 2. Five members shall constitute a quorum.

ARTICLE VI.—Qualification of Voters.

SECTION 1. No one shall be eligible to office, entitled to vote or participate in the transactions of the Society, unless he shall have been a member at least three months, and shall not be in arrears to the Society.

SECTION 2. In the election of officers only life or annual members shall be entitled to vote.

ARTICLE VII.—Expenses of Officers and Members.

No officer or member shall receive compensation or expenses for attending the meetings or exhibitions or for services rendered the Society unless such attendance or service was upon the written order of the board of managers.

ARTICLE VIII.—Salaries.

The salaries of the treasurer and secretary shall be fixed annually by the Society.

ARTICLE IX.—Neglect of Duty.

Any officer failing or neglecting to discharge his duties may be removed by a two-third vote of all the members of the board of managers, after hearing, and upon a ten (10) days' notice in writing, subject however to the approval of the board of ex-presidents and vice-presidents as herein provided.

ARTICLE X.—Alterations.

SECTION 7. This constitution may be altered or amended, at the annual meetings in January, by a vote of two-thirds of the members in attendance.

Amendments.

All amendments to the constitution, to be voted upon at the annual meeting of the Society in January, must be submitted to the meeting of the officers of this Society, in September preceding said annual meeting.

Mr. J. H. Haldeman, ex-President, offered the following:

Resolved. That the adoption of the amended constitution be passed upon at the regular meeting of the Society, January, 1888. Agreed to.

The report of the committee appointed to audit the treasurer's report was read by the secretary, together with the report of the auditing committee.

It was moved that the report of the auditing committee be adopted, so far as relates to the treasurer's report, and the same to be entered upon the minutes. Agreed to.

TREASURER'S REPORT.

JOHN B. RUTHERFORD, *Treasurer, in account with Pennsylvania State Agricultural Society.*

1886.	*Dr.*		
Jan. 20.	To balance in treasury,		$75 54
	To cash loans from Thomas H. Downing, $200; A. Wilhelm, $250; E. P. Jenison, $100; John B. Rutherford, $100; James Miles, $250; W. W. Speer, $250; James J. Dull, $100; D. W. Seiler, $100; B. Landreth, $250; C. L. Bailey, $200; H. C. Demming, $150; John J. Nissley, $100; John J. Shoemaker, $100; George Blight, $200; J. Ring & Son, $100; Joseph Montgomery, $100; George W. Hunter, $200; James Doak, $100,		2,850 00
	To life memberships—H. C. Demming, $50; Jos. D. Ditman, $50; C. R. Hoopes, $50; Cyrus Chambers, $50; H. Palmer, $50; Henry Small, $50; R. J. C. Walker, $50: E. E. Kent, $50; A. C. Chase, $50; John Lucas, $50; Thomas W. Ackley, $50; Burnet Landreth and three brothers, $200; Louis Wagner, $50; James E. Gillingham, on account, $35,		835 00
	To donations from Sharpless Bros., $200; Geo. W. Childs, $200; Ford & Kendig, $200; J. M. Vance & Co., $200; Louis Wagner, $50; J. H. Bonnell, $50; Hanson Bros., $5; John T. Morris, $25; John Wanamaker, $517 09,		1,447 09
	To cash from A. Wilhelm, loan,	$1,862 18	
	To cash from A. Wilhelm, loan,	1,999 30	
	To cash from John B. Rutherford,	390 00	
			4,251 48
	To Hathaway note,		665 19
	To Landreth & Son, special premium, M. Geary,		16 00
	To State appropriation,		2,000 00
	To cash from International Exhibition Company,		2,946 00
	To cash from J. W. Reinboth,		1,218 04

To cash by C. H. Ghiskey, $6; A. P. Brown, $3,	$9 00	
To cash from Robert Nebinger,	2 00	
To cash from A. Wilhelm, C. Eichele,	5 00	
		$16 00
To cash from Percival Roberts, premium donated,		6 00
To cash from Pennsylvania Railroad Company,		2,000 00
To cash from D. W. Seiler, Secretary,		200 00
To cash from Robert Buist,		25 00
To cash from D. W. Seiler, for Davis Longacre,	$45 00	
To cash from D. W. Seiler, for A. S. Haulsworth,	50 00	
To cash from D. W. Seiler, for W. R. Jones & Son, entry fee,	10 00	
		105 00
To cash from J. A. Stovell, annual membership,		2 00
To cash from C. R. Hoopes (in bills),	$66 18	
To cash from C. R. Hoopes (in cash),	12 90	
		79 08
To cash from Thomas Sinclair & Son,		50 00
To cash from Thirteenth and Fourteenth Street Passenger Railway Company,		200 00
To proceeds Exhibition at Philadelphia, September 6 to 18—		
To cash, admissions,	$17,393 82	
To Pennsylvania Railroad, tickets,	4,462,67	
To Philadelphia & Reading Railroad, admissions,	2,728 61	
To Perkiomen Railroad Company, admissions,	68 80	
To concessions and baggage room,	2,166 14	
		26,820 04
To cash from D. W. Seiler, Secretary,	$514 40	
To cash from D. W. Seiler, hay sold,	17 35	
		531 75
To cash from D. W. Seiler, amount refunded by American Feed Company,		85 54
To debit salary account of D. W. Seiler, Recording Secretary, for fifty annual memberships, made by him,		100 00
		$46,537 75

1886. *Cr.*	
Paid premiums of 1885,	$4,197 33
Paid premiums of 1886,	8,739 50
Paid printing for 1885,	2,060 67
Paid printing for 1886,	1,017 95
Paid notes and interest,	15,391 90
Paid employés, clerks, stile men, labor, and superintendence,	3,717 26

Paid buildings and repairs,	$1,931 40
Paid rents,	848 29
Paid sundry bills, gas, postage, &c.,	2,116 50
Paid music,	896 00
Paid racing,	1,945 00
Paid transportation,	433 99
Paid hay and feed,	1,732 99
Paid D. W. Seiler, recording secretary, account salary,	650 00
Paid D. W. Seiler, recording secretary, account salary,	100 00
Paid treasurer's salary,	500 00
Balance,	258 97
	$46,537 75

The undersigned committèe, to audit the account of John B. Rutherford, treasurer, report that we find it correct, as stated, and a balance in his hands of two hundred and fifty-eight dollars and ninety-seven cents.

WM. HOLSTEIN,
J. THOMAS STAHLEY,
S. A. HUMMEL,
Auditors.

The committee also recommend that hereafter, in justice to the president, secretary, and treasurer, that there should be attached a regular voucher to every bill.

The committee further recommend that a committee of three be appointed, whose services shall be paid for, to contract all bills, and that the president of the Society shall be a member of the committee *ex-officio.*

On motion the cash in the hands of the retiring treasurer, John B. Rutherford, was ordered to be transferred to John J. Nissley, the newly elected treasurer.

Mr. WILHELM. I will state for the information of the members, it is absolutely necessary that we should have a finance committee, to whom all bills shall be reported. I have been attending to that duty for two years. Perhaps you gentlemen are not aware that, although your Society was incorporated by the Legislature of Pennsylvania in 1851, no books were ever kept until January, 1885. It may be surprising. Our books have now been prepared, and the records have been prepared also. There are bills however that have been presented in such a shape that my friend Mr. Parsons would not recognize them as such. I make the motion. It is, that the secretary prepare and formulate the vouchers, and that they be printed for use hereafter.

It was seconded and agreed to.

Mr. WILHELM. I think that the addition of members to the committee of arrangements should be made discretionary; that the president and four members should be made the committee to thus consist of five, with such an additional number as may be deemed necessary, not exceeding eleven.

It was moved that the president be authorized to appoint a committee of arrangements for the next exhibition, and all business thereto, said committee to consist of five, with the privilege of making it eleven at his discretion.

Agreed to.

Mr. WILHELM. Now in regard to a mortgage. We sought legal advice, and we were told by the best legal talent that we as a corporation cannot obtain the loan of money on an ordinary mortgage without owning real estate, because that is the principle required. If it must issue a mortgage, it must be in the form of a chattel mortgage. Now I say in regard to myself, it was not my desire to advance the money. I believe I understand the situation. There were notes maturing. I had issued these from time to time, and on the 10th of March last this judgment was given. We had been told subsequently that the committee of arrangements had decided upon and arranged a resolution that there should be issued and executed a mortgage to me for the amount. This was done and approved by the executive committee.. I think it is eminently proper that this should be known.

Mr. SEILER. There seems to be a question as to the amount due Mr. McConkey. I would suggest, therefore, that the president appoint some one as a representative of the president and the Society; Mr. McConkey another gentleman, and the two thus appointed select a third party.

Mr. MCCONKEY. I think the fair thing would be to pass a resolution in a quiet kind of way, and give me an order for the amount of the treasury. My bills were made up from what I had actually paid out to various gentlemen, and that I had expended on behalf of the Society.

Mr. SEILER. My own suggestion is fair to the gentlemen; he to appoint one, the president one, and the two thus appointed a third. I suggest to Mr. McConkey that he accept that. I make that motion then, Mr. President, that a committee of three be appointed in the manner I have indicated. I think that is eminently the proper shape in which to put it. If Mr. McConkey accept that suggestion, it should be so provided. I think it is due Mr. McConkey.

There is another matter in reference to which you have started today, and have made considerable progress,—not as much as I had hoped for, though. You want a finance committee who shall coöperate with your president and the committee of arrangements,—a finance committee consisting of three or five gentlemen—to whom all bills shall be referred before being paid by the treasurer through that channel, and you then would know precisely where all your money has gone. I move that the president be empowered to appoint a committee of five to whom must be referred all financial claims upon the Society.

Agreed to.

Mr. WILHELM. You also want a printing committee, as we had last year.

Mr. SEILER. I move also that the president appoint a committee to take charge of all the printing for this year.

Mr. WILHELM. You have heard that motion, for the appointment of a committee of three, who shall supervise all printing during the year 1887.

It was agreed to.

Mr. PARSONS. I understood that something was said relative to a committee to petition the Legislature.

A MEMBER. I think it would be well if there were some organized committee to have charge of the matter, and the importance and ne-

cessity of the appropriation to be brought to the attention of legislators by that means.

Mr. PARSONS. I move that the president be directed to appoint a committee, not to exceed five, of which the recording secretary shall be one, to represent the Society before the finance committees of the Legislature in the procurement of an appropriation to relieve the Society from present pecuniary embarrassment.

The PRESIDENT. You have heard the motion, that the incoming president appoint a committee, of which the recording secretary shall be one, to prepare a bill to be submitted to the Legislature, granting an appropriation for this Society, the committee to also present the claims of this Society to the members of the Legislature.

Mr. SEILER offered the following:

Resolved, That the action of the executive committee and committee of arrangements in executing a mortgage and warrant to A. Wilhelm for the sum of $7,618 19, for this amount, be and the same is hereby approved.

Agreed to.

HARRISBURG, *January 28, 1887.*

Pursuant to the call by the president, the Executive Committee met at twelve o'clock noon.

Members present—Messrs. Taggart, Shaner, Blight, Chambers, Taylor, Egle, Rutherford, Tripp, McDonald, Haldeman, Ziegler, Mackey, Miller, Paxson, Nissley and Seiler.

The condensed minutes of the Society meeting were read and approved.

President Wilhelm informed the committee that he had called them together to request that the Executive Committee should appoint a committee of arrangements as he preferred their action in this matter.

The financial condition of the Society was then discussed. Mr. Seiler informed the committee that the prospect of the passage of our appropriation bill was very favorable, and moved that the president be empowered to appoint a committee of three in connection with the president. Said committee to take charge of the legislation for the Society, and prepare a bill for an appropriation of $50,000.

Agreed to.

The President appointed Messrs. Haldeman, Seiler and Mackey, when, on amendment, the same was increased to five (5) members, the president appointing Messrs. J. A. Paxson and J. S McKean.

Several propositions for leasing the grounds were read.

On motion adjourned until two o'clock P. M.

TWO O'CLOCK P. M.

The President called the meeting to order,

When Mr. Mackey moved, that the action of the Executive Committee at Philadelphia, at a meeting on September 29, 1886, in reference to the leasing of its buildings and grounds be reconsidered.

Agreed to.

Mr. McDonald moved that the resolution passed on the above date be rescinded.

Agreed to.

Mr. Seiler offered the following:

Resolved, That the applications for the use of the grounds be referred to the incoming committee of arrangements, with power to act.

Agreed to.

Mr. MACKEY. *Resolved*, That the members of the committee of arrangements for the year 1886, be requested to serve on the same committee for this year, and that the secretary be instructed to notify them of this action.

Agreed to.

Mr. Seiler presented the resignation of Elbrige McConkey, corresponding secretary as follows:

HARRISBURG, *January 19, 1887.*

A. WILHELM, ESQ, *President State Agricultural Society:*

DEAR SIR: Having been again elected corresponding secretary of the Society, I desire to return my thanks for the honor conferred. My physical condition is and has been of such a nature as to prevent me from performing the duties of the office in a manner satisfactory to the members of the organization, and I herewith tender my resignation for the reasons above stated.

For the uniform kindness and courtesy I have experienced at your hands I return my heartfelt thanks, and if it is in my power to render you any assistance in the future you cannot hesitate to command me.

Very truly yours,

ELBRIDGE MCCONKEY.

When it was

Resolved, That the resignation of Elbridge McConkey, corresponding secretary, be accepted, and the same be entered on the minutes.

Agreed to.

Dr. Paxson moved that J. Schall Wilhelm be reëlected clerk to the president and general book-keeper for this year, at a compensation to be fixed by the committee.

Agreed to.

Mr. Seiler announced the death of ex-President James Miles, of Erie county, and, on motion, Messrs. Seiler, Haldeman and Paxson were appointed a committee to prepare suitable resolutions; whereupon the committee presented the following, which were approved and ordered to be entered on the minutes of the Society, and a copy forwarded to the family by the secretary:

WHEREAS, The Executive Committee of the State Agricultural Society has heard of the death of James Miles, ex-president of this Society; therefore, be it

Resolved, That in the death of ex-President James Miles this Society has lost an officer who, for many years, gave to the interest of agriculture, and to this Society, his untiring efforts for their success; one who from boyhood was educated in this great interest, and who was successful in all his undertakings, and who for three years presided over this Society with dignity and credit.

Resolved, That in his death the Society loses one whose judgment was impartial, whose kindness of heart endeared him to all who came in contact with him as an officer or citizen, and whose loss to the Society it is most difficult to estimate.

Resolved, That this Society, through its secretary, express to the family of our deceased member our great sympathy in their loss; and

Resolved, That a copy of this resolution be transmitted to the family and placed upon the minutes of this Society.

On motion, the committee of arrangements were requested to meet at the office of Mr. Paxson, 319 Walnut street, Philadelphia, February 5, 1887, at 11 o'clock A. M.

Adjourned.

D. W. SEILER,
Secretary.

EXECUTIVE COMMITTEE.
FAIR GROUNDS, *September 14, 1887.*

The meeting was called to order by First Vice-President J. A. Paxson in the absence of President Wilhelm, who was detained at home by severe and serious sickness.

Members present, Messrs. Kennedy, Ziegler, Branson, Rutherford, McDonell, Nissley, L. H. Twaddell, Shaner and Mackey, of the Executive Committee, and Messrs. Doyle, Hughes, Jamison, Wilson, Demming, Ackley and Palmer of the committee of arrangements.

Mr. Paxson announced that he would like the two committees to meet together.

A telegram from J. Schall Wilhelm was read announcing the serious illness of his father, A. Wilhelm, president.

Mr. Paxson, in view of this fact, offered the following, which on motion was forwarded to the president:

PHILADELPHIA, PA., *September 14, 1887.*

Mr. A. WILHELM, *President:*

DEAR SIR: The following action had at a meeting of the Executive Committee was directed to be transcribed from the minutes and forwarded to you.

At a meeting of the Executive Committee of the Pennsylvania State Agricultural Society held this day information was given of your serious illness. On motion, it was unanimously

Resolved, That this committee extends to you our sincere sympathy in this hour of your affliction, and expresses the hope that your illness will take a more favorable turn, and that you may be soon again in the enjoyment of your usual good health.

Extract from the minutes.

(Signed) J. A PAXSON, *First Vice-President.*

D. W. SEILER, *Secretary.*

A communication from the Home of Free and Accepted Masons of Philadelphia thanking the Society for courtesies extended, was read and ordered to be filed.

Protest of W. H. Jones & Son against the award made to Barker Bros. in the Devon class was also read; also, the protest of William Fairweather in the Ayrshire class.

On motion of Mr. Hoopes, the whole question was referred to a committee of three, Messrs. Palmer, Shaner and T. Waddell, with full power to act, and whose decision shall be final.

Agreed to.

Mr. Seiler moved that the dates of our next exhibition in 1888 be now selected, and that the first Monday in September be selected as the opening day, continuing two weeks.

Dr. Kennedy gave notice that he would offer amendments to the constitution at the January meeting in 1888.

After discussion, Mr. Seiler moved that the Executive Committee adjourns to meet at Harrisburg on the first Monday in October to consider any amendments to be presented.

Which on motion was amended to meet on Saturday, the 17th inst., on the grounds at twelve o'clock noon. Agreed to.

Mr. Demming informed the committee that there was a possibility of there being an extra session of the Legislature called this year and suggested that in the event of such a session a committee on legislation should be appointed, which was agreed to, when the chairman appointed Messrs. Demming, Seiler and Rutherford on said committee.

On motion adjourned.

D. W. SEILER, *Secretary*.

PHILADELPHIA, SATURDAY, *September 17, 1887*.
FAIR GROUNDS, 12 O'CLOCK NOON.

The meeting was called to order by acting President Paxson—present Messrs. Nissley, Rutherford, McDowell, Mackey, Kennedy, Neiman, Branson and Seiler—when Dr. Kennedy gave notice of his intention to offer amendments to the constitution at the next meeting of the Society relating to officers and their duties, to meetings, and qualifications of voters.

On motion of Mr. Neiman, adjourned.

D. W. SEILER, *Secretary*.

LIST OF PREMIUMS AWARDED BY THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY.

Thirty-Third Annual Exhibition, Philadelphia, September 5–17, 1887.

GROUP I—Horses and Mules.

CLASS 1.—THOROUGHBREDS.

J. Howard Lewis, Jr., Media, Pennsylvania, stallion "Stampede," sixteen years, first premium,	$50 00
Aristides Welch, Station A, Philadelphia, stallion "Palmerston," seven years, second premium,	35 00
J. Howard Lewis, Jr., Media, Pennsylvania, brood mare "Blossom," eleven years, first premium,	40 00

Your committee on thoroughbred horses, mares and colts respectfully report:—

That there were few to compete for a premium, to wit.: three stallions over five years old, and two brood mares, and no colts or fillies.

We award the first premium for stallions to "Stampede," by "War Dance," first dam Dolly Morgan, by "Revenue," and on account of his personal merits, his performances. his pedigree and get.

The second premium is awarded to the stallion "Palmerston" on account of the purity of his blood.

The owner of "Faugh a Ballagh" failed to produce an authentic pedigree. The first premium for mares is awarded to brood mare "Blossom" by "Pat Malloy."

The committee is of the opinion that the brood mare "Delaware" though of authentic pedigree, does not fully come up to the requirements for a premium.

Respectfully submitted,

THOS. J. JORDAN,
GEO. G. LOBELL, *Chairman.*

CLASS NO. 2—SECTION 15.

SCALE OF POINTS IN JUDGING HORSES.

The range of judgment will extend from a cipher (0) up to the figures indicating perfection on each point.

STRUCTURAL POINTS. [For any Class or Breed.]	Perfection.	Steve Bailey.	Expectation.	Almontonian.	Mogul.	Tom Brown	Mambrino Hassan.	Maxey Cobb, Jr.
1. HEAD.—The size should be in proportion to the size of the animal. The form should be wide between the jaws, broad between the eyes, with prominent brain development: clean and bony, with lips neat and compressed, and nostrils active and delicate,	4	3½	3	3	3	2	Not registered. Ineligible.	Not registered. Ineligible.
2. EYE AND EAR.—Character is shown in these organs. Not only the size and fullness of the eye, but its expression must be considered. The ear should be active and thin, and generous in length,	4	3½	3	3	2¾	3		
3. NECK.—This point will include the setting on of the head, the length and shape of the neck, and the free development of the windpipe, especially at the throttle,	6	5½	5	4	4	3		
4. SHOULDERS AND FOREARMS.—This point will include the slope and strength of the shoulders, the height of the withers and the form and muscles of the forearms, both inside and out,	8	5	6½	5	6	5		
5. BARREL, COUPLING AND CROUP.—This embraces the length, depth, and roundness of the body, with the strength and spread of the loin, and the proper elevation of the croup,	10	8	6½	6	6½	7		
6. HIPS, QUARTERS, STIFLES AND GASKINS.—The symmetry of the hip, the breadth and strength of the quarters, the spread of the stifles, and the muscular development of the gaskins, inside and out, are to be considered in this point,	12	9	10	9	10	7		
7. HOCKS, KNEES, LEGS AND PASTERNS.—This point includes the strength and clean-cut articulation of all the members of the hock and knee joints, the angle of the hocks, the character and strength of the cannon bones, and the angle and character of the pasterns,	14	8	10½	9	10	½		
8. FEET.—The general shape of the feet, their position when at rest, the width of the heels, the strength and healthy growth of the walls, as well as evidences of internal trouble, will be embraced in this point,	10	5	8	7	7½	7		
9. COLOR.—According to public taste the leading colors may be classed as follows: Bay, dark chestnut, brown, black, roan, gray. All white markings beyond a star and one or two white feet are objectionable,	6	6	6	4½	6	2		
10. SIZE.—This will be determined by the class to which this scale is applied. The model park-horse is the model farm-horse, and he should be sixteen hands, weighing 1,200 pounds. The road and trotting-horse not less than fifteen and a half hands, and other breeds according to their uses,	10	7	8	9	8	8		
11. SYMMETRY AND STYLE.—This embraces the natural and unrestrained carriage of the head and tail, and the outline of form and figure, as presented in a state of animation,	8	7½	5	5	5½	4		
12. ACTION WITHOUT SPEED.—This will embrace the action and use of the limbs at the walk and at the slow trot, in which the difference between a dragging motion and the quick, trappy lifting of the feet will be considered. The right use of the knee and hock is a necessity,	8	5	7½	5	7	5		
	100	73	79	70½	76¼	61½		

HISTORICAL POINTS. *[For Registered Animals Only.]*								
13. PEDIGREE.—This is the most important single point in the whole scale, and yet it is the one that has received the least attention. Consider well what the sire and dam have each inherited, what each has done as a performer, and what each has produced in the stud. Then consider the qualifications of the two grandsires and the grandams in the same way. If the animal under judgment is running-bred, consider the running qualifications of his ancestors, but if trotting-bred, look only to the trotting qualifications. The value of a pedigree is in the merit of the immediate crosses, viewed in the light of inheritance, performance and production,	50	20	25	28	30	20		
[Points 14 and 15 alternative. Exhibitors shall select one or the other, but not both. Perfection in each is 50.] 14. PERFORMANCE.—Ability to perform well compensates for shortcomings in the inheritance. Nothing but technical r.c r.'s can be considered on this point. Any record is better than no record. Every animal intended to produce trotters should have his or her speed developed to some extent. The character and precision of the gait, with freedom from all artificial appliances, must enter into the value of this point, . . . 15. CHARACTER OF OFFSPRING.—This point applies only to aged and tried sires and dams. The credits will be awarded according to the number and class of fast performers from a given animal—the age and opportunities of competitors being considered,	50	. . .	. . .	*4				
	200	93	104	102½	106½	81½		

*Almontonian is the sire of Jerry Almont, 2:27½.

First premium, Mogul, ... 106½
Second premium, Expectation, ... 104

L. E. MACLEOD,
BENJAMIN HOOPES, } *Judges.*
J. MONTGOMERY,

CLASS No. 1—SECTION 17.

SCALE OF POINTS IN JUDGING HORSES.

The range of judgment will extend from a cipher (0) up to the figures indicating perfection on each point.

STRUCTURAL POINTS. [*For any Class or Breed.*]	Perfection.	Wingate.	Hi Henry.	Dr. Van.
1. HEAD.—The size should be in proportion to the size of the animal. The form should be wide between the jaws, broad between eyes, with prominent brain development; clean and bony, with lips neat and compressed, and nostrils active and delicate	4	3	3½	2½
2. EYE AND EAR.—Character is shown in these organs. Not only the size and fullness of the eye, but its expression must be considered. The ear should be active and thin, and generous in length	4	3½	3	2½
3. NECK.—This point will include the setting on of the head, the length and shape of the neck, and the free development of the windpipe, especially at the throttle	6	5	5½	3
4. SHOULDERS AND FOREARMS.—This point will include the slope and strength of the shoulders, the height of the withers and the form and muscles of the forearms, both inside and out	8	6	6	5
5. BARREL, COUPLING AND CROUP.—This embraces the length, depth and roundness of the body, with the strength and spread of the loin, and the proper elevation of the croup	10	8	9	5½
6. HIPS, QUARTERS, STIFLES AND GASKINS.—The symmetry of the hip, the breadth and strength of the quarters, the spread of the stifles, and the muscular development of the gaskins, inside and out, are to be considered in this point	12	8	9	6½
7. HOCKS, KNEES, LEGS AND PASTERNS.—This point includes the strength and clean-cut articulation of all the members of the hock and knee joints, the angle of the hocks, the character and strength of the cannon bones, and the angle and character of the pasterns	14	10	10	7½
8. FEET.—The general shape of the feet, their position when at rest, the width of the heels, the strength and healthy growth of the walls, as well as evidences of internal trouble, will be embraced in this point	10	8½	7	8
9. COLOR.—According to public taste the leading colors may be classed as follows: Bay, dark chestnut, brown, black, roan, gray. All white markings beyond a star and one or two white feet are objectionable	6	4	6	5
10. SIZE.—This will be determined by the class to which this scale is applied. The model park-horse is the model farm-horse, and should be sixteen hands, weighing 1,200 pounds. The road and trotting horse not less than fifteen and a half hands, and other breeds according to their uses	10	7½	8	2
11. SYMMETRY AND STYLE.—This embraces the natural and unrestrained carriage of the head and tail, and the outline of form and figure, as presented in a state of animation	8	6	7½	3
12. ACTION WITHOUT SPEED.—This will embrace the action and use of the limbs at the walk and at the slow trot, in which the difference between a dragging motion and the quick, trappy lifting of the feet will be considered. The right use of the knee and hock is a necessity	8	6½	7	6½
	100	76	81½	57

HISTORICAL POINTS.

[*For Registered Animals Only*]

13. PEDIGREE.—This is the most important singe point in the whole scale, and yet it is the one that has received the least attention. Consider well what the sire and dam have each inherited, what each has done as a performer, and what each has produced in the stud. Then consider the qualifications of the two grandsires and the grandams in the same way. If the animal under judgment is running-bred, consider the running qualifications of his ancestors, but if trotting-bred, look only to the trotting qualifications. The value of a pedigree is in the merit of the immediate crosses, viewed in the light of inheritance, performance and production . .	50	20	85	22½
[Points 14 and 15 are alternative. Exhibitors shall select one or the other, but not both. Perfection in each is 50.]				
14. PERFORMANCE.—Ability to perform well compensates for shortcomings in the inheritance. Nothing but technical records can be considered on this point. Any record is better than no record. Every animal intended to produce trotters should have his or her speed developed to some extent. The character and precision of the gait, with freedom from all artificial appliances, must enter into the value of this point	50			
15. CHARACTER OF OFFSPRING.—This point applies only to aged and tried sires and dams. The credits will be awarded according to the number and class of fast performers from a given animal—the age and opportunities of competitors being considered				
	200	96	116½	79½

First premium, Hi Henry, ... 116½
Second premium, Wingate, ... 96½

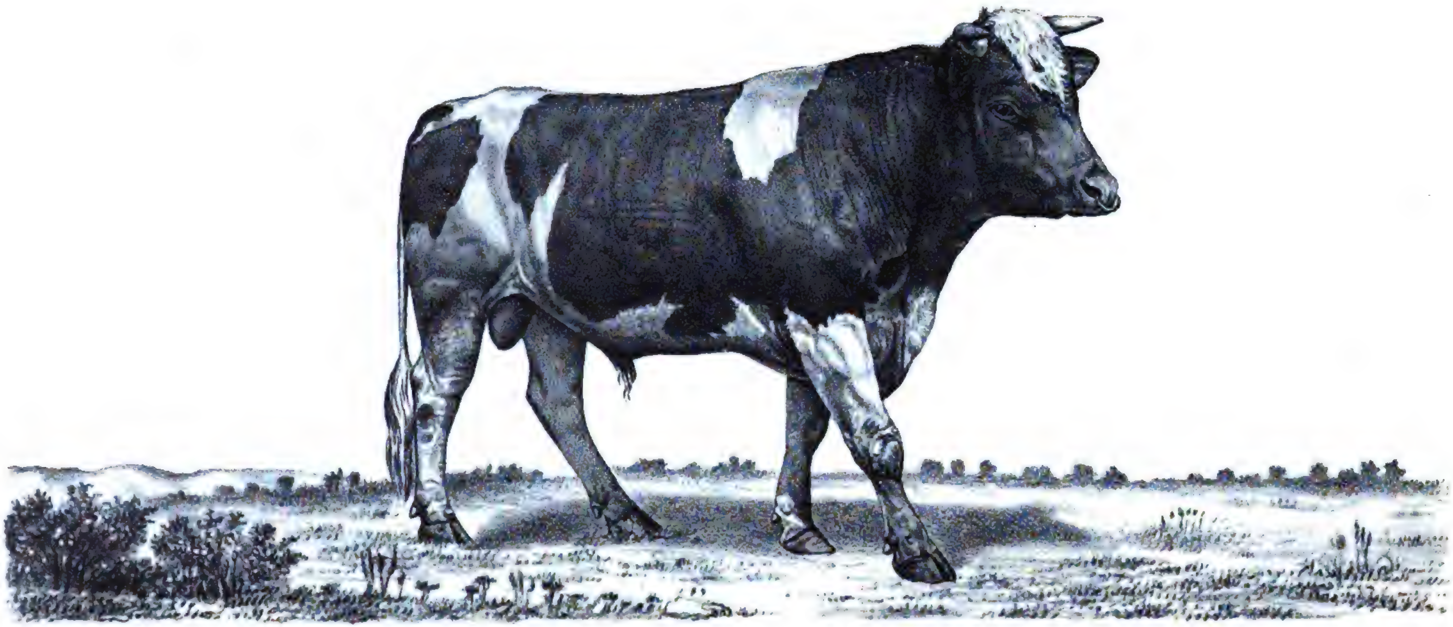
L. E. MACLEOD,
BENJAMIN HOOPES,
J. MONTGOMERY,
Judges.

CLASS 2—SECTION 18.

SCALE OF POINTS IN JUDGING HORSES.

The range of judgment will extend from a (0) up to the figures indicating perfection on each point.

STRUCTURAL POINTS. [*For any Class or Breed.*]	Perfection.	Rigoletto.	Warcliffe.	Alcanace.
1. HEAD.—The size should be in proportion to the size of the animal. The form should be wide between the jaws, broad between the eyes, with prominent brain development; clean and bony, with lips neatly compressed and nostrils active and delicate, . .	4	3	3	3
2. EYE AND EAR.—Character is shown in these organs. Not only the size and fullness of the eye, but its expression must be considered. The ear should be active and thin and generous in length, ...	4	3	3½	3
3. NECK.—This point will include the setting on of the head, the length and shape of the neck and the free development of the wind-pipe, especially at the throttle, ...	6	4½	4½	4
4. SHOULDERS AND FOREARMS.—This point will include the slope and strength of the shoulders, the heigth of the withers and the form and muscles of the forearms, both inside and out, ...	8	6	6	5½
5. BARREL, COUPLING AND CROUP.—This embraces the length, depth and roundness of the body, with strength and spread of the loin and the proper elevation of the croup, ...	10	7	7	8
6. HIPS, QUARTERS, STIFLES AND GASKINS.—The symmetry of the hip, the breadth and strength of the quarters, the spread of the stifles and the muscular development of the gaskins inside and out, are to be considered in this point, ...	12	9	8½	8½
7. HOCKS, KNEES, LEGS AND PASTERNS.—This point includes the strength and clean-cut articulation of all the members of the hock and knee joints, the angle of the hocks, the character and strength of the cannon bones and the angle and character of the pasterns, ...	14	9½	9½	9
8. FEET.—The general shape of the feet, their position when at rest, the width of the heels, the strength and healthy growth of the walls, as well as evidences of internal trouble, will be embraced in this point, ...	10	8	8	8½
9. COLOR.—According to public taste the leading colors may be classed as follows: Bay, dark chestnut, brown, black, roan, gray. All white markings beyond a star and one or two white feet are objectionable, ...	6	5½	6	5½
10. SIZE.—This will be determined by the class to which this scale is applied. The model park-horse is the model farm-horse, and he should be sixteen hands, weighing 1,200 pounds. The road and trotting-horse not less than fifteen and a half hands and other breeds according to their uses, ...	10	7	6	7
11. SYMMETRY AND STYLE.—This embraces the natural and unrestrained carriage of the head and tail, and the outline of form and figure, as presented in a state of animation, ...	8	6½	7	6
12. ACTION WITHOUT SPEED.—This will embrace the action and use of the limbs at the walk and at the slow trot, in which the difference between a dragging motion and the quick, trappy lifting of the feet will be considered. The right use of the knee and hock is a necessity, ...	8	6	7	6
	100	75	76	74
HISTORICAL POINTS. [*For Registered Animals Only.*]				
13. PEDIGREE.—This is the most important single point in the whole scale, and yet it is the one that has received the least attention. Consider well what the sire and dam have each inherited, what each has done as a performer and what each has produced in the				



DUDLEY.

HOLSTEIN BULL.—WINNER FIRST PRIZE, BETWEEN 1 AND 2 YEARS OLD, PENNSYLVANIA STATE FAIR, 1885.
OWNED BY LACKAWANNA BREEDERS' ASSOCIATION, WAVERLY, PA.

stud. Then consider the qualifications of the two grandsires and the grandams in the same way. If the animal under judgment is running-bred, consider the running qualifications of his ancestors, but if trotting-bred, look only to the trotting qualifications. The value of a pedigree is in the merit of the immediate crosses, viewed in the light of inheritance, performance and production,	50	22	25	15
[Points 14 and 15 are alternative. Exhibitors shall select one or the other, but not both. Perfection in each is 50].				
14. PERFORMANCE.—Ability to perform well compensates for shortcomings in the inheritance. Nothing but technical records can be considered on this point. Any record is better than no record. Every animal intended to produce trotters should have his or her speed developed to some extent. The character and precision of the gait, with freedom from all artificial appliances, must enter into the value of this point,	50			
15. CHARACTER OF OFFSPRING.—This point applies only to aged and tried sires and dams. The credits will be awarded according to the number and class of fast performers from a given animal—the age and opportunities of competitors being considered,				
	200	97	101	89

First premium, Warcliffe, ... 101
Second premium, Rigoletto, ... 97

L. E. MACLEOD,
BENJAMIN HOOPES, Judges.
J. MONTGOMERY,

Grand Prize No. 2.

Walter Barrett, Philadelphia, first premium, ... $75 00

STANDARD TROTTING STALLIONS, MARES AND FILLIES.

Avondale Stock Farm, Avondale, Pennsylvania, stallion, "Mogul," six years, first premium, ...	50 00
C. Frank Barrett, Philadelphia, Pennsylvania, stallion, "Expectation," second premium, ...	35 00
Daniel J. Engle, Marietta, Pennsylvania, stallion, "Hi Henry," between three and four years, first premium, ...	30 00
Dr. T. J. Jackson, Ramney Stock Farm, Maryland, stallion, "Wingate," three years, second premium, ...	25 00
Avondale Stock Farm, Avondale, Pennsylvania, stallion, "Warcliffe," two years, first premium, ...	20 00
G. and W. H. Corson, Plymouth, Pennsylvania, stallion, "Rigoletto," two years, second premium,"	15 00
Daniel G. Engle, Marietta, Pennsylvania, stallion, "Message," between one and two years, first premium, ...	15 00
Daniel G. Engle, Marietta, Pennsylvania, stallion, "Radnor," between one and two years, second premium, ...	10 00
Daniel G. Engle, Marietta, Pennsylvania, brood mare, "Argentine," twelve years old, first premium, ...	50 00
Daniel G. Engle, Marietta, Pennsylvania, filly, "Instinct," between three and four years, first premium, ...	20 00
Daniel G. Engle, Marietta, Pennsylvania, filly, "Mary Linn, between two and three years, first premium, ...	20 00
G. and W. H. Corson, Plymouth, Pennsylvania, filly, "Miss Jefferson," two years, second premium, ...	15 00
C. Frank Barrett, Philadelphia, Pennsylvania, filly, "Eleanor Regina," one year, first premium, ...	15 00

The Committee on Standard Breed Stallions, Mares and Fillies make the above awards.

L. E. MACLEOD.
BENJ. P. HOOPES.
J. MONTGOMERY.

Grand Prize No. 4.

S. K. Nissley, Florin, Pennsylvania, ...	$50 00
S. K. Nissley, Florin, Pennsylvania, stallion, "Delgard," six years, ...	42 50
C. H. Beyers, Norristown, Pennsylvania, stallion, "Mambrino Hasson," twelve years, ...	42 50
David C. Souders, Mountville, Lancaster county, Pennsylvania, stallion, "Dr. Armand," between four and five years, first premium, ...	40 00
M. Robinson, Paoli, Pennsylvania, stallion, "Longfellow;" four years, second premium, ...	30 00
W. E. Phillips, Abrams, Montgomery county, Pennsylvania, stallion, "Kentucky King," three years, first premium, . .	30 00
M. Robinson, Paoli, Pennsylvania, stallion, "Goldfinder," three years, second premium, ...	25 00
J. R. Mansfield, Germantown, Pennsylvania, stallion, "Hawthorne, Jr.," two years, second premium, ...	15 00

C. Frank Barrett, Philadelphia, Pennsylvania, stallion, "Richbin," two years, first premium, ... $20 00
J. R. Mansfield, Germantown, Pennsylvania, stallion, "Stenton," one year, first premium, ... 15 00
S. K. Nissley, Florin, Pennsylvania, stallion, "Almo," one year, second premium, ... 10 00
M. Robinson, Jr., brood mare, "Molly B.," twelve years, first premium, ... 50 00
Robert Exley, brood mare, "Bessie," seven years, second premium, ... 30 00
J. R. Mansfield, Germantown, Pennsylvania, filly, "Bessie," three years, first premium, ... 20 00
W. E. Phillips, filly, "Daisy," three years, second premium, . 15 00
David C. Souders, Mountville, Pennsylvania, filly, "Nancy," between two and three years, first premium, ... 20 00
W. E. Phillips, filly, "Lady Penn," two years, second premium, ... 15 00
R. C. Horn, Philadelphia, Pennsylvania, filly, "Ida C.," one year three months, first premium, ... 15 00
S. K. Nissley, Florin, Pennsylvania, filly, "Lulu," one year, second premium, ... 10 00

We find "Delgard" and "Mambrino Hasson" of equal merits and agree to divide first and second premiums.

We, the undersigned judges of class third and grand prize, beg leave to submit this report as herein stated.

T. J. JACKSON, M. D.,
C. N. BARNARD,
DANIEL G. ENGLE.

Stallion between four and five years.

J. L. Kunkle, Irwin, Westmoreland county, Pennsylvania, stallion, "Brilliant," four years, second premium, . . . 30 00
W. P. Wilson, Irwin, Westmoreland county, Pennsylvania, stallion, "For Show," three years, first premium, ... 30 00
J. L. Kunkle, Irwin, Westmoreland county, Pennsylvania, stallion, "Mansfield Beau," three years, second premium, . 25 00

Stallion between two and three years.

J. L. Kunkle, Irwin, Westmoreland county, Pennsylvania, stallion, "King Wallace," two years, first premium, . . . 20 00
W. P. Wilson, Irwin, Westmoreland county, Pennsylvania, stallion, "Jakie," two years, second premium, ... 15 00

Brood Mares over four years.

J. L. Kunkle, Irwin, Westmoreland county, Pennsylvania, brood mare, "Diamond Queen," four years, first premium, . 40 00

Filly between two and three years.

J. L. Kunkle, Irwin, Westmoreland county, Pennsylvania, filly, "Jennie," second premium, ... 15 00

DRAUGHT HORSES.

Stallion over five years.

S. K. Nissley, Florin, Pennsylvania, stallion, "Killian," six years, first premium, ... 50 00

J. Roth, Allentown, Pennsylvania, stallion, "Jumbo," six years, second premium, ... $30 00

Stallion between four and five years.

John Painter, Irwin, Pennsylvania, stallion, "Prince Charley," four years, first premium, ... 40 00

Stallion between two and three years.

J. B. Kendig, stallion, "Paul, Jr.," between two and three years, second premium, ... 10 00

Brood mare with foal at her foot.

J. Roth, brood mare, "Jennie," six years, first premium, . . 40 00

Brood mare over four years.

J. L. Kunkle, Irwin, Pennsylvania, brood mare, "Collie," four years, first premium, ... 30 00
J. B. Kendig, brood mare, "Fan," four years, second premium, 20 00

Filly between two and three years.

J. Roth, filly, "Lizzie," two years two months, second premium, ... 10 00

Filly between three and four years.

J. B. Kendig, filly, "Nellie," between three and four years, second premium, ... 15 00

Filly between one and two years.

J. B. Kendig, filly, "Flora," between one and two years, second premium, ... 10 00

To A. WILHELM,
President Pennsylvania State Agricultral Society:

We, the committee on classes four and five, respectfully make the foregoing report.

WM. TAYLOR,
JOHN S. MILLER,
S. A. HUMMEL.

HARNESS AND SADDLE HORSES.

Pair of Light Harness (15½ *hands high*).

C. Frank Barrett, Philadelphia, Pa., "Ogontz," six years, and "Elwood Medium, Jr.," five years, first premium. . $35 00
Charles Williams, Buckingham, Bucks county, Pa., "Tom," five years and "Jerry," six years, second premium 20 00

Pair Coach Horses (*16 hands high*).

Charles Williams, Buckingham, Bucks county, Pa., "Dick," seven years and "Fany," six years, first premium 35 00
Charles Williams, Buckingham, Bucks county, Pa., "Ben," six years and "Jere," seven years, second premium, ... 20 00

PAIR DRAUGHT HORSES.

M. P. Wilson, Irwin, Pa., "John and Milt," five years, first premium 25 00

MARE OR GELDING (FOR FARMERS' USE.)

J. Roth, Allentown, Pa., gelding, "Jerry," four years, first premium	$20 00

ROADSTER.

Frank Pettit, Philadelphia, Pa., roadster, "Kerner," five years, first premium	25 00
C. M. Randall, Olney, Pa., roadster, "Manor Boy," between six and seven years, second premium	15 00

SADDLE AND HARNESS HORSES.

Saddle Horse, gaited.

J. H. Lewis, Jr., Media, Pa., first premium	30 00

Saddle Pony, gaited.

Horace Twaddell, West Philadelphia, saddle pony, "Robin," nine years, first premium	10 00

Children's Pony (14½ hands high).

S. K. Nissley, children's pony, "Topsy," six years, second premium	5 00
Daniel G. Engle, children's pony, "Simon," six years, second premium	5 00

Children's Pony (12 hands high).

U. Robinson, Jr., Paoli, Pennsylvania, "Peggie," ten years, first premium,	10 00

Children's Pony (12 hands high, broken to harness).

U. O. Wood, Haddenfield, New Jersey, "Tiny," twelve years, first premium,	10 00

TOBIAS BARTO,
H. E. HERSHEY,
GEORGE W. HILL,
Committee.

CATTLE.

HERD PREMIUMS.

J. O. Edwards & Son, Youngstown, Ohio, herd, Short Horns, first premium,	75 00
G. W. Milliken, Youngstown, Ohio, herd Herefords, first premium,	75 00

SHORT HORNS.

J. O. Edwards & Son, Youngstown, Ohio, "Arden of Pleasant Hill," four years, bull, second premium,	35 00
J. O. Edwards & Son, Youngstown, Ohio, cow, "Ella Moore 7th," four years, first premium.	50 00

Cow between three and four years.

J. O. Edwards & Son, Youngstown, Ohio, cow, "Ella Moore 8th," three years, first premium,	30 00

J. O. Edwards & Son, Youngstown, Ohio, cow, "Rea Daisy 3d," three years, second premium, ... $20 00

Heifer between two and three years.

J. O. Edwards & Son, Youngstown, Ohio, heifer, "Cherry Ardis 2d," two years, first premium, ... 20 00

J. O. Edwards & Son, Youngstown, Ohio, heifer, "Red Fancy 5th," two years, second premium, ... 10 00

HEREFORDS.

G. W. Milliken, Youngstown, Ohio, bull, "Leotard," four years, second premium, ... 35 00

Bull between one and two years.

G. W. Milliken, Youngstown, Ohio, bull, "Sir Harry," one year, first premium, ... 30 00

G. W. Milliken, Youngstown, Ohio, bull, "Trumbull," one year, second premium, ... 20 00

Cow over four years.

G. W. Milliken, Youngstown, Ohio, cow, "Favorite," four years, first premium, ... 50 00

G. W. Milliken, Youngstown, Ohio, cow, "Jesemine," four years, third premium, ... Honorable commendation.

Cow between two and three years.

G. W. Milliken, Youngstown, Ohio, cow, "Esther," three years, second premium, ... $20 00

Heifer between two and three years.

G. W. Milliken, Youngstown, Ohio, heifer, "Lady," two years, first premium, ... 20 00

G. W. Milliken, Youngstown, Ohio, heifer, "Lott," two years, second premium, ... 10 00

Heifer between one and two years.

G. W. Milliken, Youngstown, Ohio, heifer, "Lulu," one year, first premium, ... 15 00

G. W. Milliken, Youngstown, Ohio, heifer, "Flora," one year, second premium, ... 10 00

HERD—DEVONS.

W. H. Jones & Sons, South Montrose, Pennsylvania, herd, first premium, ... 75 00

HERD—AYRSHIRES.

William Lindsay, Elizabeth, New Jersey, herd, first premium, ... 75 00

J. O. Magie & Son, Elizabeth, New Jersey, herd, second premium, ... 40 00

Devons.

Bull over three years.

Banker Bros., bull, "Prince of Wales," four years, first premium, ... $50 00

W. H. Jones & Son, South Montrose, Pennsylvania, bull, "Retainer," three years, second premium, ... 35 00

Bull between two and three years.

Banker & Bro., bull, "Prince of Promise," two years, second premium, ... 20 00

Bull between one and two years.

W. H. Jones & Son, South Montrose, Pennsylvania, bull, "Defender." one year, first premium, ... 30 00

Cow over four years.

Banker Bros., cow, "Bright Promise," twelve years, first premium, ... 50 00

W. H. Jones, South Montrose, Pennsylvania, cow, "Surprise," nine years, second premium, ... 30 00

W. H. Jones, South Montrose, Pennsylvania, cow, 6 years, third premium, ... Honorable commendation.

Cow between three and four years.

William H. Jones & Son, South Montrose Pennsylvania, cow, "Blanchdella," three years, first premium, ... $30 00

Heifer between two and three years.

W. H. Jones & Son, heifer, "Lady Lynnhurd," two years, first premium, ... 20 00

W. H. Jones & Son, heifer, "Tempest Queen." two years, third premium, ... Honorable commendation.

Heifers between one and two years.

W. H. Jones & Son, heifer, "Theresha," one year, second premium, ... $10 00

Ayrshires.

Bull over three years.

William Fairweather, Meadville, Pennsylvania, bull, "Dunkeld," three years, first premium, ... 50 00

J. O. Magie & Sons, Elizabeth, Pennsylvania, bull, "Stanley," three years, second premium, ... 35 00

Bull between two and three years.

William Lindsay, bull, "Augustus Douglass," two years, first premium, ... 40 00

J. O. Magie & Sons, Elizabeth, Pennsylvania, bull, "Brown King," two years, second premium, ... 20 00

William Fairweather, Meadville, Pennsylvania, bull, "Bran Mors," two years, third premium, . . . Honorable commendation.

Bull between one and two years.

J. O. Morgie & Sons, Elizabeth, Pennsylvania, bull, "Duke of Elinora," one year, first premium, ... $30 00
William Lindsay, bull, "Earl of Woodville," one year, first premium, ... 30 00
L. E. Werz, Elizabeth, Pennsylvania, bull, "Prince Union," one year, second premium, ... 20 00

Cow over four years.

William Lindsay, cow, "Maud Murray," four years, first premium, ... 50 00
J. O. Magie & Sons, Elizabeth, Pennsylvania, cow, "Dolly Gray," four years, second premium, ... 30 00
William Lindsay, cow, "Queen of Aron," four years, third premium, ... Honorable Commendation.

Cow between three and four years.

William Lindsay, cow, "Ayrshire Drummond," three years, first premium, ... $20 00
William Fairweather, Meadville, Pennsylvania, cow, "Lucky Essex," three years, second premium, ... 10 00
J. O. Magie & Sons, Elizabeth, Pennsylvania, cow, "Brown Lady Sixth," three years, third premium, Honorable Commendation.

Heifer between two and three years.

J. O. Magie & Sons, Elizabeth, Pennsylvania, heifer, "Mary Gold Second," first premium, ... $15 00
William Fairweather, Meadville, Pennsylvania, heifer, "Pennsylvania Fair," two years, second premium, . . . 10 00

Heifer between one and two years.

William Fairweather, Meadville, Pennsylvania, heifer, "Philadelphia Fair," one year, first premium, ... 15 00
J. O. Magie & Sons, Elizabeth, Pennsylvania, heifer, "Mary Lind," one year, second premium, ... 10 00

JOHN A. WALLACE,
WM. H. VOGDES,
J. W. NICHOLSON.

POLLED ANGUS.

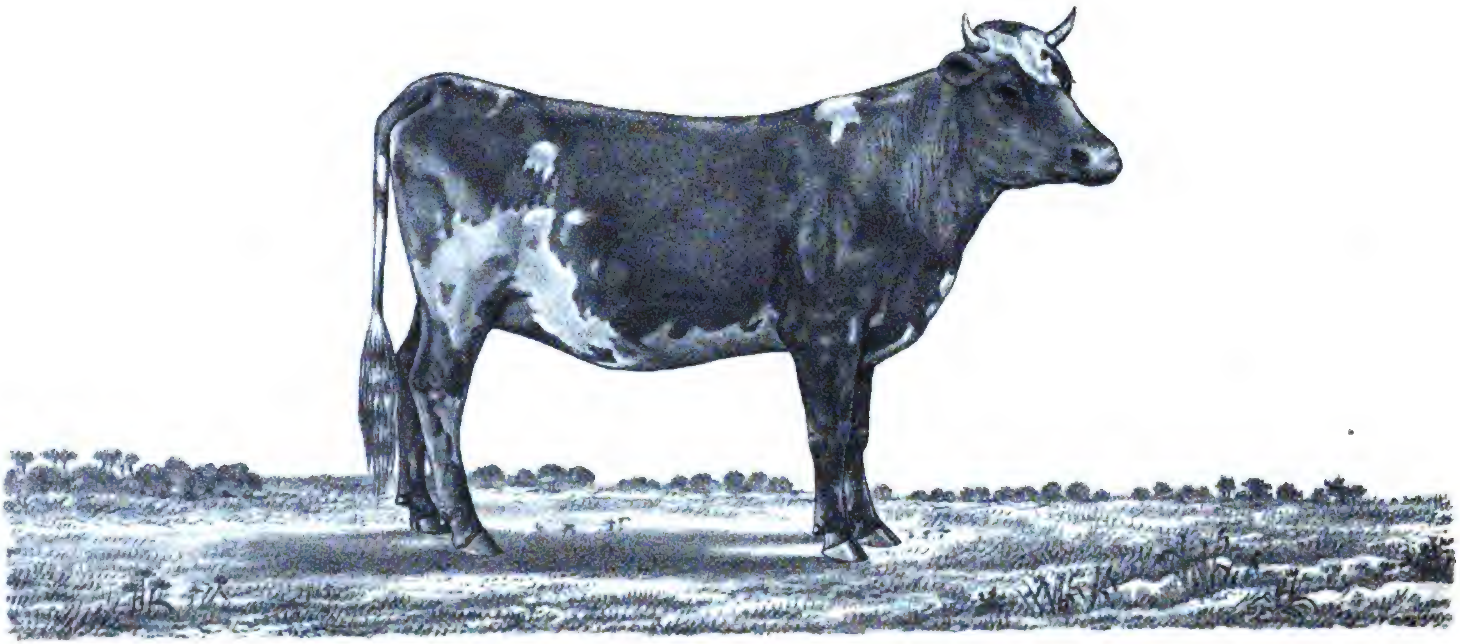
Barton, Garinger, Washington C. H., Ohio, first premium, . $150 00

The undersigned, a jury of revision specially appointed by the president to reconsider the award on aged Ayshire bulls, respectfully report that they have carefully examined William Fairweather's bull "Dunkeld," J. O. Magie & Sons bull "Stanley," and William Singerly's bull "McDuff of Orwell," and that we unanimously agree that Mr. Fairweather's bull "Dunkeld" is entitled to the first premium, and J. O. Magie & Sons bull "Stanley" to the second premium.

J. SHANER,
L. H. TWADDELL,
HENRY PALMER.

STATE FAIR GROUNDS,
PHILADELPHIA, *September 16, 1887.*

The undersigned, a jury of revision on awards on live stock, specially appointed by the President, respectfully report that they have ex-



"PHILADELPHIA FAIR."

AYRSHIRE HEIFER.—WINNER FIRST PRIZE PENNSYLVANIA STATE FAIR, 1887.

OWNED BY WM. FAIRWEATHER, MEADVILLE, PA.

amined the cattle of Banker Bros., upon which a protest was formerly entered by B. F. Jones, said protest claiming that Banker Bros.' Devon heifers, in the two and three year old classes, were misrepresented as to ages, they being older animals.

We hereby pronounce the protest in our judgment sustained, and recommend that Banker Bros.' said heifers, viz: "Mary Anna" and "Effie Banker," be *disqualified from competition* in all classes in which they have been entered in this fair.

L. H. Twaddell,
J. Shaner,
Henry Palmer,
Committee.

Holsteins.

Herd Prize.

Lackawanna Breeders' Association, Waverly, Pennsylvania, herd, first premium,	$75 00
Caleb Walters, West Chester, Pennsylvania, herd, second premium,	40 00

Bull over three years.

Lackawanna Breeders' Association, Waverly, Pennsylvania, bull, first premium,	50 00
William M. Singerly, Philadelphia, bull, "Prince David," four years, second premium,	35 00
Lackawanna Breeders' Association, Waverly, Pennsylvania, bull, "Dudly," three years, third premium,	H. C.

Bull between two and three years.

Lackawanna Breeders' Association, Waverly, Pennsylvania, bull, "Cresson," two years, first premium,	$40 00
Brackbill, Kendig & Landis, bull, between two and three years, second premium,	20 00

Bull between one and two years.

Caleb M. Walters, West Chester, Pennsylvania, bull, "Shadelana Sultram," one year, first premium,	30 00
Brackbill, Kendig & Landis, bull, between one and two years, second premium,	20 00
William M. Singerly, Philadelphia, bull, "Girtha S," one year, third premium,	H. C

Cow over four years.

Lackawanna Breeders' Association, Waverly, Pennsylvania, cow, "Bankie," eight years, first premium,	$50 00
William M. Singerly, Philadelphia, cow, "Antical," nine years, second premium,	30 00
Brackbill, Kendig & Landis, cow, four years, third premium,	H. C.

Cow between three and four years.

William M. Singerly, Philadelphia, cow, "Valleina," three years, first premium,	$30 00
Brackbill, Kendig & Landis, cow, "Millie," between three and four years, second premium,	20 00

William M. Singerly, Philadelphia, three years, third premium, ... H. C.

Heifer between two and three years.

Brackbill, Kendig & Landis, heifer, "Mink," between two and three years, first premium, ... $20 00

William M. Singerly, Philadelphia, heifer, "Fullia S.," two years, second premium, ... 10 00

Lackawanna Breeders' Association, Waverly, Pennsylvania, heifer, "Cephyse," two years, third premium, ... H. C.

Heifer between one and two years.

Caleb M. Walters, West Chester, Pennsylvania, heifer, "Bellvue Klaazi," one year, first premium, ... $15 00

Lackawanna Breeders' Association, Waverly, Pennsylvania, heifer, "Tullia 3d," one year, second premium, ... 10 00

Caleb M. Walters, West Chester, Pennsylvania, heifer, "Fiallings Second's Beauty," third premium, ... H. C.

We, the undersigned committee, appointed to pass our judgment upon cattle entered to compete in class 10, render the foregoing as our judgment.

E. J. DURNELL,
J. E. PIOLLET,
L. J. CULVER,

JERSEY'S CATTLE.

Herd prize.

American Jersey Cattle Club, S. Kirkpatrick, Mt. Pleasant, Pennsylvania, prize, ... $100 00

HERD PRIZE JERSEYS.

S. Kirkpatrick, Mt. Pleasant, Pennsylvania, herd, first premium, ... 75 00

Jas. W. Mercur, Willingsford, Pennsylvania. herd, second premium, ... 40 00

Bull over three years.

Arthur G. Jack & Co., Media, Pennsylvania, bull, "Blossom Gilderoy," four years, first premimu, ... 50 00

D. C. Souders, Mountville, Pennsylvania, bull, "Blazon," between three and four years, second premium, ... 35 00

J. Roth, Allentown, Pennsylvania, bull, "Black Prince of Linden," five years, third premium, . . . Honorable commendation.

Bull between two and three years.

S. Kirkpatrick, Mt. Pleasant, Pennsylvania, bull, "Lorne Pogis 2d," two years, first premium, ... $40 00

Henry Bullock and U. C. Kerbaugh, Millersville, Pennsylvania, bull, "Amy's Pretender," two years, second premium, 20 00

Jas. W. Mercur, Willingsford, Pennsylvania, bull, "Cumas Boy," two years, third premium, ... Honorable commendation.

Bull between one and two years.

E. C. Knight, Philadelphia, bull, "Earl of Collingswood," first premium, ... $30 00

E. C. Knight, Philadelphia, bull, "North King's Son," second premium, ... $20 00
J. E. Gillingham, Villewood, Pennsylvania, bull, "Rex of Claremont," third premium, ... Honorable commendation.

Cow over four years.

S. Kirkpatrick, Mt. Pleasant, Pennsylvania, cow, "Gold Bead," first premium, ... $50 00
J. Roth, Allentown, Pennsylvania, cow, "Royal Beauty," second premium, ... 30 00
M. Robinson, Jr., Paoli, Pennsylvania, cow, "Mattie of Beechwood," third premium, ... Honorable commendation.

Cow between three and four years.

J. W. Mercur, Wallingsford, Pennsylvania, cow, "Mane of Netherworth," first premium, ... $30 00
S. Kirkpatrick, Mt. Pleasant, Pennsylvania, cow, "Princess of Ashantic," second premium, ... 20 00
E. C. Knight, Philadelphia, cow, "Young Agnes," third premium, ... Honorable commendation.

Heifer between two and three years.

E. C. Knight, Philadelphia, heifer, "Lady Knight," first premium, ... $20 00
J. W. Mercur, Willingsford, Pennsylvania, heifer, "Netherworth Duchess," second premium, ... 10 00
S. Kirkpatrick, Mt. Pleasant, Pennsylvania, heifer, "Pride of Fairmount," third premium, ... Honorable commendation.

Heifer between one and two years.

E. C. Knight, Philadelphia, heifer, "Ella of Collingswood," first premium, ... $15 00
J. Roth, Allentown, Pennsylvania, heifer, "Beauty Pero," second premium, ... 10 00
J. E. Gillingham, Villewood, Pennsylvania, heifer, "Star of Claremount," third premium, ... Honorable commendation.

Heifer under one year.

J. E. Gillingham, Villewood, Pennsylvania, heifer, "Dawn of Claremont," first premium, ... $20 00
E. C. Knight, Philadelphia, heifer, "Anne Knight of C.," second premium, ... 10 00

We hereby certify that the premiums as above awarded are correct to the best of our knowledge.

Heulings Lippincott,
Louis M. Lusson.

Guernseys—Cattle.

Herd prize.

George LeMonte, Bound Brook, New Jersey, herd, first premium, ... $75 00
Ezra Michenor, Carversville, Pennsylvania, herd, second premium, ... 40 00

Bull over three years.

George LeMonte, Bound Brook, New Jersey, bull, "Accident," first premium, ... $50 00
George LeMonte, Bound Brook, New Jersey, bull, "Sir Champion Sixth," second premium, ... 35 00

Bull between two and three years.

Joseph Krouse, Roselle, New Jersey, bull, "General Dart," first premium, ... 40 00
William Lindsay, Elizabeth, New Jersey, bull, "Beau of Norwood," second premium, ... 20 00

Bull between one and two years.

Ezra Michenor, Carversville, Pennsylvania, bull, "Mohawk's Gift," first premium, ... 30 00
William Lindsay, Elizabeth, New Jersey, bull, "Oscar, Jr.," second premium, ... 20 00

Cow over four years.

George LeMonte, Bound Brook, New Jersey, cow, "Lily Garis," second premium, ... 30 00
Ezra Michenor, Carversville, Pennsylvania, cow, "Hattie Woodward," first premium, ... 50 00

Cow between three and four years.

Ezra Michenor, Carversville, Pennsylvania, cow, "Euphemia," first premium, ... 30 00
George LeMonte, Bound Brook, New Jersey, cow, "Little Nell," second premium, ... 20 00

Heifer between two and three years.

Joseph Krouse, Roselle, New Jersey, heifer, "Polly Wetoun," first premium, ... 20 00
George LeMonte, Bound Brook, New Jersey, heifer, "Mary Daisy,' second premium, ... 10 00

Heifer between one and two years.

William Lindsay, Elizabeth, New Jersey, heifer, "Fire-fly," first premium, ... $15 00
George LeMonte, Bound Brook, New Jersey, heifer, "Little Primrose," second premium, ... 10 00

J. W. NICHOLSON,
THOMAS SHARPLESS,
JOSEPH EVANS.

SHEEP.

MERINOS AND DELAINES.

Ram over three years.

S. A. McCalmant, Hickory, Washington county, Pennsylvania, ram, first premium, ... $20 00
James Glass, Burgettstown, Washington county, Pennsylvania, ram, second premium, ... 10 00

Ram two years and under three years.

James Glass, Burgettstown, Washington county, Pennsylvania, ram, first premium,	$15 00
J. G. Paxton & Sons, Houstonville, Pennsylvania, ram, second premium	10 00

Ram one year and under two years.

J. G. Paxton & Sons, Houstonville, Pennsylvania, ram, first premium,	10 00
James Glass, Burgettstown, Washington county, Pennsylvania, second premium,	5 00

Ram lamb.

S. A. McCalmant, Hickory, Washington county, Pennsylvania, first premium,	10 00
James Glass, Burgettstown, Washington county, Pennsylvania, second premium,	5 00

Pen three ewes over three years.

S. A. McCalmant, Hickory, Washington county, Pennsylvania pen three ewes, first premium,	20 00
James Glass, Burgettstown, Washington county, Pennsylvania, pen three ewes, second premium,	15 00

Pen three ewes over two years and under three years.

J. G. Paxton & Sons, Houstonville, Washington county, Pennsylvania, pen three ewes, first premium,	15 00
James Glass, Burgettstown, Washington county, Pennsylvania, pen three ewes, second premium,	10 00

Pen three ewes, one year and under two.

J. G. Paxton & Sons, Houstonville, Pennsylvania, pen three ewes, first premium,	15 00
James Glass, Burgettstown, Pennsylvania, pen three ewes, second premium,	10 00

Pen three ewe lambs.

S. A. McCalmant, Hickory, Pennsylvania, pen three ewe lambs, first premium,	10 00
James Glass, Burgettstown, Pennsylvania, pen three ewe lambs, second premium,	5 00

MERINO SWEEPSTAKES.

S. A. McCalmant, Hickory, Pennsylvania, premium	25 00

Mr. President and Gentlemen of the Pennsylvania State Agricultural Society: The undersigned, acting as an expert in judging in class 17 *Merino*, respectfully reports that he made a careful examination of the sheep competing for the respective prizes. Observing the rules of the International Sheep Show, the following awards were made on values in scoring.

I would further state, the value in scoring for the Sweepstake prize was so close, between James Glass and S. A. McCalmant, that the award is only made by $\frac{46}{135}$ in favor of S. A. McCalmant.

JOHN McDOWELL.

SOUTHDOWNS.

Ram, two years or over.

J. G. Paxton & Sons, Houstonville, Pennsylvania, ram, first premium, ... $20 00
Jesse K. Cope, West Chester, Pennsylvania, ram, second premium, ... 15 00

Ram, one year and under two.

J. G. Paxton & Sons, Houstonville, Pennsylvania, ram, first premium, ... 15 00
Jesse K. Cope, West Chester, Pennsylvania, ram, second premium, ... 10 00

Ram Lamb.

J. G. Paxton & Sons, Houstonville, Pennsylvania, ram lamb, first premium, ... 10 00
Jesse K. Cope, West Chester, Pennsylvania, ram lamb, second premium, ... 5 00

Pen three ewes, two years or over

J. G. Paxton & Sons, Houstonville, Pennsylvania, pen three ewes, first premium, ... 20 00
Jesse K. Cope, West Chester, Pensylvania, pen three ewes, second premium, ... 15 00

SOUTHDOWNS.

Pen three ewes, one year and under two years.

J. G. Paxton & Sons, Houstonville, Pennsylvania, pen three ewes, first premium, ... 15 00
Jesse K. Cope, West Chester, Pennsylvania, pen three ewes, second premium, ... 10 00

Pen three ewe lambs.

J. G. Paxton & Sons, Houstonville, Pennsylvania, pen three ewe lambs, first premium, ... 10 00
Jesse K. Cope, West Chester, Pennsylvania, pen three ewe lambs, second premium, ... 5 00

RAM. SHROPSHIRE, TWO YEARS AND OVER.

Lackawanna Breeders' Association, Waverly, Pennsylvania, ram, first premium, ... 20 00

RAM, HAMPSHIRE, TWO YEARS AND OVER.

Charles T. Walters, ram, second premium, ... 15 00

SHROPSHIRE RAM, ONE YEAR AND UNDER TWO.

Caleb M. Walters, ram, first premium, ... 15 00
Lackawanna Breeders' Association, Waverly, Pennsylvania, ram, second premium, ... 10 00

SHROPSHIRE.

Ram Lamb.

Lackawanna Breeders' Association, Waverly, Pennsylvania, ram lamb, first premium, ... 10 00
Caleb M. Walters, ram lamb, second premium, ... 5 00

Pen three ewes, two years and over.

Lackawanna, Breeders' Association, Waverly, Pennsylvania, pen three ewes, first premium, ... $20 00
Caleb M. Walters, pen three ewes, second premium, ... 15 00

Pen three ewes, one year and under two.

Lackawanna Breeders' Association, pen three ewes, first premium, ... 15 00
Charles T. Walters, pen three ewes, second premium, . . . 10 00

Pen three ewe lambs.

Lackawanna Breeders' Association, pen three ewes, first premium, ... 10 00
Charles T. Walters, pen three ewe lambs, second premium, . 5 00

Sweepstakes.

J. G. Paxton & Sons, Houstonville, Pennsylvania, sweepstakes, first premium, ... $25 00

LINCOLNS.

Ram, two years and over.

Caleb M. Walters, West Chester, Pennsylvania, ram, first premium, ... 20 00
Caleb M. Walters, ram, second premium, ... 15 00

Ram, one year and under two.

Caleb M. Walters, ram, first premium, ... 15 00
Caleb M. Walters, ram, second premium, ... 10 00

Ram Lamb.

Caleb M. Walters, ram lamb, first premium, ... 10 00
Caleb M. Walters, ram lamb, second premium, ... 5 00

Pen three Ewes two years and over.

Caleb M. Walters, West Chester, Pennsylvania, pen three ewes, first premium, ... 20 00
Caleb M. Walters, pen three ewes, second premium, ... 15 00

Pen three Ewes one year and under two years.

Caleb M. Walters, pen three ewes, first premium, ... 15 00
Caleb M. Walters, pen three ewes, second, premium, ... 10 00

Pen three Ewes, Lambs.

Caleb M. Walters, pen three ewe lambs, first premium, . . 10 00
Caleb M. Walters, pen three ewe lambs, second premium, . 5 00

Sweepstakes.

Caleb M. Walters, sweepstakes, first premium, ... 25 00

FAT SHEEP.

Five Long or Combing Wools.

Caleb M. Walters, West Chester, Pennsylvania, Lincoln ewe, first premium, ... 15 00

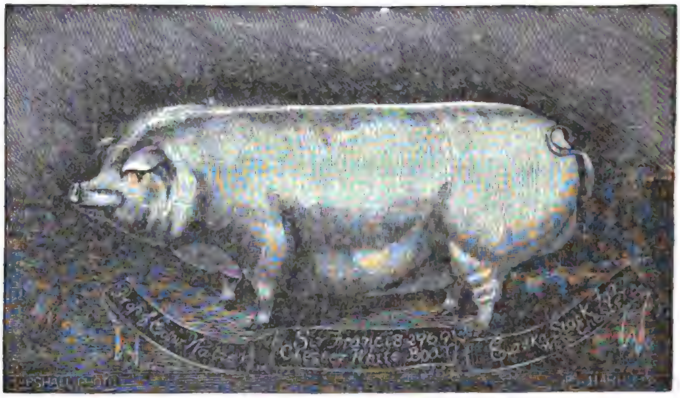
Five Middle Wool or Mutton.

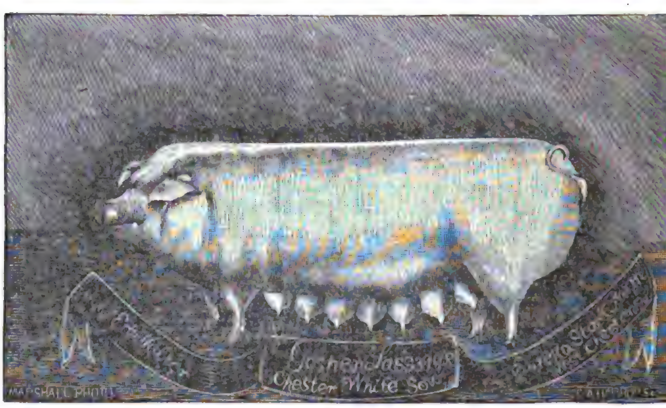
Chas. T. Walters, five middle wool or mutton, first premium, 15 00

We the undersigned committee upon classes herein mentioned respectfully submit the foregoing report with the suggestion that the class including Oxford, Hampshire and Shropshire be sub-divided to make it more satisfactory to exhibitors and judges.

C. B. BARNARD,
FRANK PETTIT.

SWINE.





CHESTERS.

Boar over two years.

Caleb M. Walters, West Chester, Pennsylvania, Boar, "Jim R," first premium, ... $20 00
E. B. Ashbridge, Williston Inn, Pennsylvania, Boar, "John," second premium, ... 10 00

Boar over one year.

Caleb M. Walters, Boar, "Royal Sixth," first premium . . . $20 00
A. Darlington Strode, West Chester, Pennsylvania, boar, second premium, ... 10 00

Boar under one year.

Caleb M. Walters, boar, "Ire Fifth," first premium, ... 15 00
A. D. Strode, West Chester, Pennsylvania, boar, "Patron," second premium, ... 5 00

Brood sow over two years.

Caleb M. Walters, brood sow, "Wayside Beauty," first premium, ... $20 00
Caleb M. Walters, brood sow, "Pride." second premium, . 10 00

Sow over one year.

E. B. Ashbridge, Williston Inn, Pennsylvania, sow, "Purity," first premium, ... 15 00
Caleb M. Walters, sow, "Bell," second premium, ... 10 00

Sow under one year.

Caleb M. Walters, sow, "Fancy," first premium, ... 10 00
Caleb M. Walters, sow, "Fancy Second," second premium . 5 00

Pen five sows over six months.

C. M. Cope, pen five sows, first premium, ... 20 00
A. D. Strode, pen five sows, second premium, ... 10 00

Pen five sows under six months.

A. D. Strode, pen five sows, first premium, ... 15 00
E. B. Ashbridge, pen five sows, second premium, ... 10 00

YORKSHIRES.

Boar over two years.

Jacob Bros., West Grove, Pennsylvania, boar, first premium, 20 00
Benjamin Hulse, Allentown, Pennsylvania, boar, second premium, ... 10 00

Boar over one year.

Benjamin Hulse, boar, first premium, ... 20 00
Sharpless A. Walters, West Chester, Pennsylvania, boar, second premium, ... 10 00

Boar under one year.

J. G. Paxton & Sons, boar, first premium, ... 15 00
Jacob Bros., boar, second premium, ... 5 00

Brood sow over two years.

J. G. Paxton & Sons, brood sow, first premium, ... 20 00
Jacob Bros., brood sow, second premium, ... 10 00

Sow under one year.

Jacob Bros., sow, first premium, ... 15 00
J. G. Paxton & Sons, sow, second premium, ... 10 00

Sow under one year.

J. G. Paxson & Sons, sow, first premium, ... 10 00
Benj. Hulse, sow, second premium, ... 5 00

Pen five sows under six months.

Jacob Bros., pen five sows, first premium, ... 15 00

CHESHIRES.

Boar over two years.

G. S. Button, Chellenango, N. Y., boar, first premium, . . . 20 00
J. Howard, Mendenhall, boar, second premium, ... 10 00

Boar over one year.

Freemar & Button, boar, first premium 20 00
J. H. Mendenhall, boar, second premium, ... 10 00

Boar under one year.

Freemar & Button, boar, first premium,	$15 00
G. S. Button, boar, second premium,	5 00

Brood sow over two years.

G. S. Button, brood sow, first premium,	20 00
Freemar & Button, brood sow, second premium,	10 00

Sow over one year.

J. H. Mendenhall, sow, first premium,	15 00
J. G. Button, sow, second premium,	10 00

Sow under one year.

J. H. Mendenhall, sow, first premium.	10 00
Freemar & Button, sow, second premium,	5 00

Pen five sows under six months.

Freemar & Button, pen five sows, first premium,	15 00

EVAN PYLE,
JOSEPH EVANS,
RUFUS C. GHEEN.

BERKSHIRES.

Boar over two years.

Caleb M. Walters, West Chester, first premium,	$20 00
James Glass, Burgettstown, Washington county Pa., second premium,	10 00

Boar over one year.

James Glass, Burgettstown, Pennsylvania, first premium,	20 00
D. H. Branson, second premium,	10 00

Boar under one year.

Caleb M. Walters, West Chester, Pennsylvania, first premium,	15 00
Jacob Bros, second premium,	5 00
Benjamin Hulse, Allentown, Pennsylvania, third premium,	H. C.

Brood sow over two years.

Caleb M. Walters, West Chester, Pennsylvania, first premium,	20 00
James Glass, Burgettstown, Pennsylvania, second premium,	10 00

Sow over one year.

Caleb M. Walters, first preminm,	15 00
D. H. Branson, second premium,	10 00

Sow under one year.

D. H. Branson, first premium,	10 00
Jacob Bros., second premium,	5 00

Pen five sows over six months old.

Caleb M. Walters, first premium,	20 00

Pen five sows under six months old.

James Glass, first premium,	15 00
Caleb M. Walters, second premium,	10 00

POLAND CHINAS.

Boar over two years.

D. H. Branson, first premium, ... $20 00

Boar over one year.

D. H. Branson, first premium, ... 20 00

Boar under one year.

S. A. McCalmant, Hickory, Pennsylvania, first premium, . . 15 00
S. A. McCalmant, Hickory, Pennsylvania, second premium, . 5 00

Brood sow over two years.

D. H. Branson, first premium, ... 20 00
S. A. McCalmant, second premium, ... 10 00

Sow over one year.

S. A. McCalmant, first premium, ... 15 00
D. H. Branson, second premium, ... 10 00

Sow under one year.

S. A. McCalmant, first premium, ... 10 00

Pen five sows under six months.

S. A. McCalmant, first premium, ... 15 00
D. H. Branson, second premium, ... 10 00

ESSEX.

Boar over two years.

Benjamin Hulse, Allentown, Pennsylvania, second premium, 10 00

Boar over one year.

Benjamin Hulse, first premium, ... 20 00
Benjamin Hulse, second premium, ... 10 00

Boar under one year.

Benjamin Hulse, first premium, ... 15 00
Benjamin Hulse, second premium, ... 5 00

Sow over one year.

Benjamin Hulse, first premium, ... 15 00
Benjamin Hulse, second premium, ... 5 00

Brood sow over two years.

Benjamin Hulse, first premium, ... 20 00
Benjamin Hulse, second premium, ... 10 00

Sow over one year.

Benjamin Hulse, first premium, ... 15 00

Sow under one year.

Benjamin Hulse, first premium, ... 10 00
Benjamin Hulse, second premium, ... 5 00

We the undersigned, a committee appointed to judge upon class 22, 23, 24 and 25, would say the foregoing is the best of our judgment and belief.

E. J. DURNALL,
WM. B. HARVEY

GROUP V—POULTRY.

CLASS 29—*Light Brahmas.*

J. S. Tomlinson & Bro., Sixteenth and Tioga streets, Philadelphia, breeding pen chicks, first premium,	$3 00
J. S. Tomlinson & Bro., pullet, first premium,	1 50
J. S. Tomlinson & Bro., cockerel, first premium,	1 50
J. S. Tomlinson & Bro., hen, first premium,	1 50
J. S. Tomlinson & Bro., hen, second premium,	1 00
J. S. Tomlinson & Bro., cockerel, second premium,	1 00
J. S. Tomlinson & Bro., cock, second premium,	1 00
J. S. Tomlinson & Bro., cock,	H. C.
J. S. Tomlinson & Bro., hen,	H. C.
George Schloendorn, Nicetown, Philadelphia, pullet, second premium,	$1 00
George Schloendorn, cockerel,	H. C.
George Schloendorn, pullet,	H. C.

Dark Brahmas.

John Lilly, Lambertsville, New Jersey, breeding pen, first premium,	$3 00
John Lilly, cockerel, first premium,	1 50
John Lilly, pullet, first premium,	1 50
John Lilly, cock, first premium,	1 50
John Lilly, hen, first premium,	1 50
John Lilly, pullet, second premium,	1 00
John Lilly, cockerel, second premium,	1 00
William Haney, Hammonton, New Jersey, cock, second premium,	1 00
William Haney, hen, second premium,	1 00

Buff Cochins.

A. H. Robinson, Fifty-nine-and-one-half street and Lansdowne avenue, Philadelphia, cockerel, first premium,	$1 50
A. H. Robinson, pullet, first premium,	1 50
A. H. Robinson, cock, first premium,	1 50
A. H. Robinson, hen, first premium,	1 50
A. H. Robinson, pullet, second premium,	1 00
B. F. Lewis, Gwynedd, Pennsylvania, cock, second premium,	1 00
B. F. Lewis, hen, second premium,	1 00

Partridge Cochins.

B. F. Lewis, Gwynedd, Pennsylvania, cock, first premium,	$1 50
B. F. Lewis, hen, first premium,	1 50
H. Vernier, Jr., 6223 Girard avenue, Philadelphia, cockerel, first premium,	1 50
H. Vernier, Jr., pullet, first premium,	1 50
H. Vernier, Jr., breeding pen, first premium,	3 00
H. Vernier, Jr., hen, second premium,	1 00
H. Vernier, Jr., pullet, second premium,	1 00

Black Cochins.

B. F. Lewis, Gwynedd, Pennsylvania, hen, first premium,	$1 50

Langshans.

H. A. Beyler, Reading, Pennsylvania, cockerel, first premium,	$1 50

H. A. Beyler, pullet, second premium,	$1 00
B. F. Lewis, Gwynedd, Pennsylvania, cock, first premium,	1 50
B. F. Lewis, hen, first premium,	1 50
Levi G. Thomas, Pine Iron Works, Pennsylvania, pullet, first premium,	1 50
Levi G. Thomas, cockerel, second premium,	1 00

American Dominiques.

Jesse G. Darlington, Fifty-third and Media streets, Philadelphia, cockerel, first premium,	$1 50
Jesse G. Darlington, pullet, first premium,	1 50
Jesse G. Darlington, pullet, second premium.	1 50
Jesse G. Darlington, cockerel, second premium,	1 50

Plymouth Rocks.

Model Bee Hive Company, Fifty-second and Jefferson streets, Philadelphia, breeding pen, first premium,	$3 00
Model Bee Hive Company, hen, first premium,	1 50
Model Bee Hive Company, cock, second premium,	1 00
Levi G. Thomas, Pine Iron Works, Pennsylvania, cockerel, first premium,	1 50
Levi G. Thomas, pullet, first premium,	1 50
Levi G. Thomas, cock, first premium,	1 50
Levi G. Thomas, pullet, second premium,	1 00
Levi G. Thomas, hen, second premium,	1 00
Levi G. Thomas, cockerel,	H. C.
H. A. Beyler, Reading, Pennsylvania, cockerel, second premium,	1 00
H. A. Beyler, pullet,	H. C.
B. F. Lewis, Gwynedd, Pennsylvania, cock,	H. C.
B. F. Lewis, hen,	H. C.

Wyandottes.

Milton H. Leidy, Blooming Glen, Pa., breeding pen, first premium	$3 00
A. H. Robinson, Fifty-nine-and-one-half street and Lansdowne avenue, Philadelphia, breeding pen,	2 00
A. H. Robinson, hen, first premium,	1 50
A. H. Robinson, cock, first premium,	1 50
A. H. Robinson, hen, second premium,	1 00
Milton H. Leidy, cockerel, first premium,	1 00
Milton H. Leidy, pullet, first premium,	1 50
S. L. Heddly, Union, Union county, N. J., breeding pen,	1 00
S. L. Heddly, pullet, second premium,	1 00
S. L. Heddly, cockerel, second premium,	1 00

Silver Gray Dorklings.

William Worrel, Wayne, Station G., Germantown, breeding pen, first premium,	3 00
William Worrel, chicks, second premium,	2 00
William Worrel, cock, first premium,	1 50
William Worrel, hen, first premium,	1 50
William Worrel, cockerel, first premium	1 50
William Worrel, pullet, first premium,	1 50
William Worrel, pullet, second premium,	1 00
William Worrel, hen, second premium,	1 00

Colored Dorkings.

William Worrel, Wayne, Station G., Germantown, hen, first premium,	1 50
William Worrel, cockerel, first premium,	1 50
William Worrel, pullet, first premium,	1 50
William Worrel, second premium,	1 00

White Dorkings.

R. Frank Moore, Milford Mills, Pa., breeding pen, first premium,	3 00
R. Frank Moore, cockerel, first premium,	1 50
R. Frank Moore, pullet, first premium,	1 50
R. Frank Moore, pullet, second premium,	1 00

Silver Spangled Hamburg.

Dana C. Souder, Mountville, Pa., cock, first premium,	1 50
Dana C. Souder, hen, first premium,	1 50
Dana C. Souder, cockerel, first premium,	1 50

Silver Penciled Hamburg.

H. A. Beyler, Reading, Pa., breeding pen, first premium,	3 00
H. A. Beyler, cock, first premium,	1 50
H. A. Beyler, hen, first premium,	1 50
H. A. Beyler, pullet, second premium,	1 00

Golden Penciled Hamburg.

H. A. Beyler, Reading, Pa., cock, first premium,	1 50
H. Beyler, hen, first premium,	1 50

Silvered Spangled Hamburg.

B. F. Lewis, hen, second premium,	1 00

JOHN E. DIEHLE,
GEORGE W. MCCRACKEN,
MARK SCHOEFIELD.

White-faced Black Spanish.

Thomas Powell, Thirty-third and Melten, Philadelphia, breeding pen, first premium,	3 00
Thomas Powell, cock, first premium,	1 50
Thomas Powell, hen, first premium,	1 50
Thomas Powell, cockerel, first premium,	1 50
Thomas Powell, pullet, first premium,	1 50
Thomas Powell, pullet,	H. C.
Thomas Powell, cockerel,	H. C.
S. L. Headly, Union, Union county, New Jersey, breeding pen, second premium,	2 00
S. L. Headly, cock, second premium,	1 00
S. L. Headly, hen, second premium,	1 00
S. L. Headly, cockerel, second premium,	1 00
S. L. Headly, pullet, second premium,	1 00
B. F. Lewis, cock,	H. C.
B. F. Lewis, hen,	H. C.

Black Minorca.

William Heany, Hammonton, New Jersey, breeding pen, first premium,	3 00
Levi G. Thomas, Pine Iron Company, Pennsylvania, cockerel, first premium,	1 50
Levi G. Thomas, pullet, first premium,	1 50
H. A. Beyler, Reading, Pennsylvania, cockerel, second premium,	1 00
H. A. Beyler, pullet, second premium,	1 00

White Monorcas.

R. Frank Moore, breeding pen, first premium,	3 00
R. Frank Moore, cockerel, first premium.	1 50
R. Frank Moore, hen, first preminm,	1 50
R. Frank Moore, breeding pen, second premium,	2 00
R. Frank Moore, cock, second premium,	1 00
R. Frank Moore, hen, second premium,	1 00
R. Frank Moore, pullet, second premium,	1 00
R. Frank Moore, pullet,	H. C.
R. Frank Moore, cockerel,	H. C.
Milton H. Leidy, cockerel, second premium,	1 00

Brown Leghorns—Single-combed.

Thomas Powell, breeding pen, first premium,	3 00
Thomas Powell, cockerel, first premium,	1 50
Thomas Powell, pullet, first premium,	1 50
Thomas Powell, cock, first premium,	1 50
Thomas Powell, hen, first premium,	1 50
Caleb H. Toland, Sixtieth and Harte avenue, Philadelphia, breeding pen, second premium,	2 00
B. F. Lewis, cock, second premium,	1 00
B. F. Lewis, hen, second premium,	1 00
S. L. Headly, breeding pen, third premium,	1 00
S. L. Headly, cock,	H. C.
S. L. Headly, hen,	H. C.

Rose-combed.

Freeman & Button, Cottons, New York, cockerel, first premium,	1 50
Freeman & Button, pullet, first premium,	1 50
Freeman & Button, pullet, second premium,	1 00
Freeman & Button, cockerel, second premium,	1 00

Dominique Leghorns.

S. L. Headly, breeding pen, first premium,	3 00
S. L. Headly, cock, first premium,	1 50
S. L. Headly, hen, first premium,	1 50

White Leghorns.

B. F. Lewis, cock, first premium,	1 50
B. F. Lewis, hen, first premium,	1 50
Michael Brison, Sixtieth and Grass Lane, breeding pen, chick, second premium,	2 00

Houdans.

G. S. Button, Chellenango, New York, breeding pen, first premium,	3 00
G. S. Button, cock, first premium,	1 50
G. S. Button, hen, first premium,	1 50
B. F. Lewis, cock, second premium,	1 00
B. F. Lewis, hen, second premium,	1 00

White Polish.

S. L. Headly, breeding pen, first premium,	3 00
S. L. Headly, cockerel, first premium,	1 50
S. L. Headly, pullet, first premium,	1 50
S. L. Headly, hen, first premium,	1 50
S. L. Headly, cockerel, second premium,	1 00
S. L. Headly, cock, second premium,	1 00
S. L. Headly, hen, second premium,	1 00
S. L. Headly, pullet, second premium,	1 00

Silver-crested Polish.

S. L. Headly, breeding pen, first premium,	3 00
S. L. Headly, pullet, first premium,	1 50
S. L. Headly, cockerel, first premium,	1 50
S. L. Headly, hen, first premium,	1 50

White-crested Black Polish.

S. L. Headly, pullet, first premium,	1 50
S. L. Headly, cockerel, first premium,	1 50

Yellow Duckwing, Game.

Westervelt, Hayward & Company, Rutherford, New Jersey, hen, first premium,	1 50

Black Breasted Red.

Westervelt, Hayward & Company, Rutherford, New Jersey, hen, first premium,	1 50
James A. Stovell, Philadelphia, breeding pen, first premium,	3 00
James A. Stovell, hen, first premium,	1 50
James A. Stovell, cock, first premium,	1 50
James A. Stovell, cockerel, first premium,	1 50
James A. Stovell, pullet, first premium,	1 50
James A. Stovell, pullet, second premium,	1 00
James A. Stovell, cockerel, second premium,	1 00

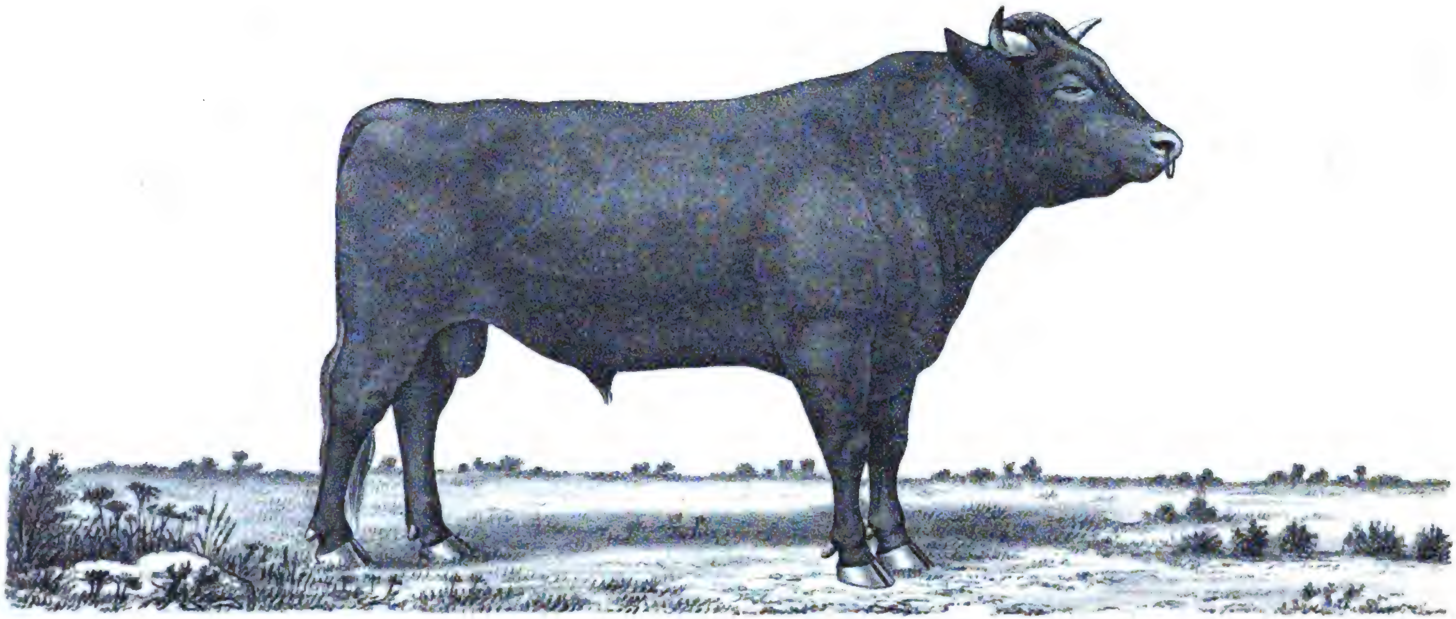
WM. FABLE,
WM. A. WEST.

Rumpless.

B. F. Lewis, Gwynedd, Pennsylvania, cock, first premium,	$1 50
B. F. Lewis, hen, first premium,	1 50
B. F. Lewis, hen, second premium,	1 00
B. F. Lewis, cock, second premium,	1 00

Frizzled.

B. F. Lewis, cock, first premium,	1 50
B. F. Lewis, hen, first premium,	1 50



"RETAINER."

DEVON BULL.—OWNED BY W. H. JONES & SON, SOUTH MONTROSE, PA.

Japanese Silkies.

H. W. Vahle, 46 North Ninth street, Philadelphia, cock, first premium,	1 50
H. W. Vahle, hen, first premium,	1 50
H. W. Vahle, hen, second premium,	1 00

Silver Duckwing Game Bantams.

Jesse G. Darlington, Fifty-third and Media street, Philadelphia, breeding pen, first premium,	3 00
Jesse G. Darlington, hen, first premium,	1 50
Jesse G. Darlington, cock, first premium,	1 50
Jesse G. Darlington, cockerel, first premium,	1 50
Jesse G. Darlington, pullet, first premium,	1 50
Jesse G. Darlington, pullet, second premium,	1 00
Jesse G. Darlington, cockerel, second premium,	1 00
J. C. Maple, Trenton, New Jersey, breeding pen, second premium,	2 00
J. C. Maple, cock, second premium,	1 00
J. C. Maple, hen, second premium,	1 00
Tomlinson & Brother, Sixteenth and Tioga street, Philadelphia, breeding pen, third premium,	1 00
Tomlinson & Brother, hen,	H. C.
Tomlinson & Brother, pullet,	H. C.

Golden Duckwing Game Bantams.

J. C. Maple, Trenton, New Jersey, breeding pen, first premium,	$3 00
J. C. Maple, hen, first premium,	1 50
J. C. Maple, cock,	H. C.
Westervelt, Hayward & Company, Rutherford, New Jersey, cock, first premium,	$1 50
Westervelt, Hayward & Company, cock, second premium,	1 00

Red Pyle Game Bantams.

J. C. Maple, Trenton, New Jersey, cock, first premium,	1 50
J. C. Maple, hen, first premium,	1 50
Westervelt, Hayward & Co., hen, second premium,	1 00
Westervelt, Hayward & Co., cock, second premium,	1 00
Westervelt, Hayward & Co., cock,	H. C.
John Filkin, Orange, New Jersey, pullet, second premium,	1 00

White Pyle Bantams.

H. A. Beyler, Reading, Pennsylvania, breeding pen, first premium,	3 00
J. C. Maple, hen, first premium,	1 50
John Filkins, Orange, New Jersey, pullet, first premium,	1 50
Westervelt, Hayward & Co., cock, first premium,	1 50
Westervelt, Hayward & Co., cockerel, first premium,	1 50
Westervelt, Hayward & Co., pullet, first premium.	1 50
Westervelt, Hayward & Co., cock, second premium,	1 00

Brown Breasted Red Game Bantam.

Westervelt, Hayward & Co., breeding pen, first premium,	3 00
Westervelt, Hayward & Co., cock, first premium,	1 50

Westervelt, Hayward & Co., hen, first premium,	$1 50
Westervelt, Hayward & Co., cockerel, first premium,	1 50
Westervelt, Hayward & Co., pullet, first premium,	1 50
Westervelt, Hayward & Co., pullet, second premium,	1 00
Westervelt, Hayward & Co., hen, second premium,	1 00

Black Breasted Game Bantam.

Jesse G. Darlington, breeding pen, first premium,	3 00
Jesse G. Darlington, hen, first premium,	1 50
Jesse G. Darlington, cockerel, first premium,	1 50
Jesse G. Darlington, hen, second premium,	1 00
Jesse G. Darlington, pullet, second premium,	1 00
Jesse G. Darlington, cockerel, second premium,	1 00
Jesse G. Darlington, cock,	H. C.
John Filkin, Orange, New Jersey, cock, first premium,	1 50
John Filkin, pullet, first premium,	1 50
Westervelt, Hayward & Co., cock, second premium.	1 00
William Henry, Hammonton, New Jersey, breeding pen, second premium,	2 00
J. C. Maple, Trenton, New Jersey, hen,	H. C.

Black Game Bantam.

John L. Baily, breeding pen, first premium,	3 00
John L. Baily, cock, first premium,	1 50
John L. Baily, hen, first premium,	1 50
John L. Baily, hen,	H. C.
Westervelt Hayward & Co., pullet, first premium,	1 50
Westervelt Hayward & Co., pullet, second premium,	1 00

Black Rose Combed Bantam.

J. C. Maple, breeding pen, first premium,	3 00
J. C. Maple, cock, first premium,	1 50
J. C. Maple, hen, first premium,	1 50
J. C. Maple, cockrel, first premium,	1 50
J. C. Maple, hen, second premium,	1 00

White Rose Combed Bantam.

J. C. Maple, cock, first premium,	1 50
J. C. Maple, hen, first premium,	1 50
J. C. Maple, pullet, first premium,	1 50

Golden Seabright Bantam.

J. C. Maple, breeding pen, first premium,	3 00
J. C. Maple, cock, first premium,	1 50
J. C. Maple, hen, first premium,	1 50
J. C. Maple, cockerel, first premium,	1 50
J. C. Maple, pullet, first premium,	1 50
J. C. Maple, pullet,	H. C.
H. A. Beyler, hen, second premium,	1 00
H. A. Beyler, cock, second premium,	1 00
H. A. Beyler, pullet, second premium,	1 00
H. A. Beyler, hen,	H. C.
Catharine E. Steffer, 1023, North Fifth street, Philadelphia, cockrel, second premium,	1 00

Silver Seabright Bantam.

J. C. Maple, hen, first premium,	1 50
J. C. Maple, cock, first premium,	1 50
J. C. Maple, cock, second premium,	1 00
Westervelt Hayward & Co., hen, second premium,	1 00
Westervelt Hayward & Co., cock,	H. C.

Buff Pekin Bantam.

R. Frank Moore, Milford, Mills, Pennsylvania, breeding pen, first premium,	3 00
R. Frank Moore, cockrel, first premium,	1 50
R. Frank Moore, pullet, first premium,	1 50
H. B. & A. F. Bancraft, Frankford, Pennsylvania, cock, first premium,	1 50
H. B. & A. F. Bancraft, hen, first premium,	1 50
H. B. & A. F. Bancraft, breeding pen, second premium,	2 00
H. B. &. A. F. Bancraft, cock, second premium,	1 00
H. B. &. A. F. Bancraft, hen, second premium,	1 00
H. B. &. A. F. Baneraft, hen,	H. C.
H. B. &. A. F. Bancraft, cock,	H. C.

Black Pekin Bantam.

R. Frank Moore, cockerel, first premium,	1 50
R. Frank Moore, pullet, first premium,	1 50

JOHN E. DEIHLE,
GEORGE W. MCCRACKEN.

TURKEYS.

Bronze Turkeys.

C. F. Lewis, one pair, first premium,	$2 00

White Holland.

B. F. Lewis, first premium,	2 00

CLASS 30—GEESE.

Toulouse Geese.

B. F. Lewis, one pair, first premium,	2 00
Freeman & Button, Coltins, New York, one pair, second premium,	1 00

White China.

B. F. Lewis, one pair, first premium,	2 00

Wild.

B. F. Lewis, one pair, first premium,	2 00

White Call Duck.

S. A. Stovell, Philadelphia, one pair, first premium,	1 50

Black Cayuga Duck.

Freeman & Button, Coltins, New York, one pair, first premium,	1 50
Freeman & Button, one pair, second premium,	1 00

Aylesburg Ducks.

B. F. Lewis, one pair, first premium, ... $1 50

Pekin Ducks.

B. F. Lewis, one pair, first premium, ... 1 50

Rouen Duck.

B. F. Lewis, one pair, first premium, ... 1 50
B. F. Lewis, one pair ducklings, second premium, ... 1 00

White Crested Duck.

B. F. Lewis, one pair, first premium, ... 1 50

White Muscovy Duck.

B. F. Lewis, one pair, first premium, ... 1 50
B. F. Lewis, one pair ducklings, second premium, ... 1 00

JOHN E. DIEHLE,
GEO. W. MCCRAKEN.

ORNAMENTAL AND CAGED BIRDS.

H. W. Vahle, Brazillian Cardinal, first premium, ... $1 00
H. W. Vahle, Mexican Cardinal, first premium, ... 1 00
H. W. Vahle, Blue Macaro, first premium, ... 1 00
H. W. Vahle, Green Macaro, first premium, ... 1 00
H. W. Vahle, Mino, first premium, ... 1 00
H. W. Vahle, White Crested Cockatoo, first premium, . . . 1 00
H. W. Vahle, Yellow Crested Cockatoo, first premium, . . 1 00
H. W. Vahle, Mexican Parrot, first premium, ... 1 00
H. W. Vahle, Amazon Parrot, first premium, ... 1 00
H. W. Vahle, Blue Head Parrot, first premium, ... 1 00
H. W. Vahle, Strawberry Finch, first premium, ... 1 00
H. W. Vahle, Zebra Finch, first premium, ... 1 00
H. W. Vahle, Magpies, first premium, ... 1 00
H. W. Vahle, Silverbacks, first premium, ... 1 00
H. W. Vahle, Widah bird, first premium, ... 1 00
H. W. Vahle, Cutcan Tucan, first premium. 1 00
H. W. Vahle, Mexican Tucan, first premium, ... 1 00
H. W. Vahle, Chaffinch, first premium, ... 1 00
H. W. Vahle, Blue Linnett, first premium, ... 1 00
H. W. Vahle, Blue Finch, first premium, ... 1 00
H. W. Vahle, European Red Squirrel, first premium, . . . 1 00
H. W. Vahle, Mexican Fox Squirrel, first premium, ... 1 00
H. W. Vahle, Gray Squirrel, first premium, ... 1 00
H. W. Vahle, Black Squirrel, first premium, ... 1 00
H. W. Vahle, Marmoset Monkey, first premium, ... 1 00
H. W. Vahle, White-faced Ringtail Monkey, first premium, . 1 00
H. W. Vahle, South American Ringtail Monkey, first premium, ... 1 00
H. W. Vahle, Angora Rabbits, first premium, ... 50
H. W. Vahle, Rough Guinea Pigs, first premium, ... 50
H. W. Vahle, Smooth Guinea Pig, first premium, ... 50
H. W. Vahle, Silver Pheasant, first premium, ... 1 00
H. W. Vahle, Gray African Parrot, first premium, ... 1 00
H. W. Vahle, Maracabo Parrot, first premium, ... 1 00

H. W. Vahle, King Parrot, first premium, ...	$1 00
H. W. Vahle, Cubian Parrot, first premium, ...	1 00
H. W. Vahle, Tugueriners Parrot, first premium, ...	1 00
H. W. Vahle, Cockatillas, first premium, ...	1 00
H. W. Vahle, Blue Mountain Loys, first premium, ...	1 00
H. W. Vahle, Rossella, first premium, ...	1 00
H. W. Vahle, Rossella, bearded, first premium, ...	1 00
H. W. Vahle, Casters, first premium, ...	1 00
H. W. Vahle, Love Birds, first premium, ...	1 00
H. W. Vahle, Shell Paroquets, first premium, ...	1 00
H. W. Vahle, Brazillian Nauda, first premium, ...	1 00
H. W. Vahle, Port Lincoln Paroquets, first premium, . . .	1 00
H. W. Vahle, Birabona Paroquets, first premium, ...	1 00
H. W. Vahle, Yellowhead, first premium, ...	1 00
H. W. Vahle, Red Weavers, first premium, ...	1 00
H. W. Vahle, Bishops, first premium, ...	1 00
H. W. Vahle, Cutthroats, first premium, ...	1 00
H. W. Vahle, White Java Sparrow, first premium, ...	1 00
H. W. Vahle, Gray Java Sparrow, first premium, ...	1 00
H. W. Vahle, Boaraboned, first premium, ...	1 00

WILLIAM FABLE,
WILLIAM A. WERT.

B. F. Lewis, Madagascar rabbits, ...	H. C.
B. F. Lewis, Himalaya rabbits, first premium, ...	50
B. F. Lewis, Angora rabbits, ...	H. C.
B. F. Lewis, Belgian rabbits, first premium, ...	50
B. F. Lewis, Egyptian rabbits, first premium, ...	50
B. F. Lewis, smooth white guinea pigs, first premium, . . .	50
B. F. Lewis, smooth colored guinea pigs, first premium, . .	50
B. F. Lewis, rough white guinea pigs, ...	H. C.
B. F. Lewis, white guineas, first premium, ...	$1 50
B. F. Lewis, white guineas, second premium, ...	1 00
B. F. Lewis, pearl guineas, first premium, ...	1 50
Keystone Incubator Company, Philadelphia, premium of . .	15 00

CLASS 31—PIGEONS AND CAGE AND ORNAMENTAL BIRDS.

Ring Doves.

Archie McKinley, 741 North Seventh street, Philadelphia, one pair, first premium, ...	$1 00
B. F. Lewis, one pair, second premium, ...	75

Red Jacobin Pigeons.

F. F. Kampe, 1123 Poplar street, Philadelphia, one pair, first premium, ...	1 00
H. W. Vahle, one pair, second premium, ...	75
J. G. Darlington, one pair, ...	H. C.

Yellow Jacobin Pigeons.

W. H. Ehringer, 1307 North Fourth street, Philadelphia, one pair, second premium, ...	75

White Jacobin Pigeons.

J. G. Darlington, one pair, first premium, ...	$1 00

Dun Jacobin Pigeons.

J. G. Darlington, one pair, first premium,	$1 00

Turbits Pigeons.

J. A. Stovell, one pair, blue tailed, first premium,	1 00
J. A. Stovell, one pair, blue tailed, second premium,	75
J. A. Stovell, one pair, red tailed, first premium,	1 00
J. A. Stovell, one pair, yellow tailed, second premium,	75
J. A. Stovell, one pair, black tailed, second premium,	75
W. H. Ehringer, yellow winged, first premium,	1 00
W. H. Ehringer, yellow winged, second premium,	75
W. H. Ehringer, red winged, first premium,	1 00
W. H. Ehringer, red winged, second premium,	75
W. H. Ehringer, black tail, first premium,	1 00
W. H. Ehringer, white tail, first premium,	1 00
Mark Schofield, Philadelphia, dun, first premium,	1 00
Mark Schofield, Philadelphia, dun, second premium,	75
Mark Schofield, Philadelphia, blue, first premium,	1 00
Mark Schofield, Philadelphia, black winged, first premium,	1 00
Mark Schofield, Pniladelphia, blue winged, first premium,	1 00
Mark Schofield, Philadelphia, white, second premium,	75
Mark Schofield, Philadelphia, black, first premium,	1 00
Mark Schofield, Philadelphia, yellow, first premium,	1 00
Mark Schofield, Philadelphia, red tail, first premium,	1 00
Mark Schofield, Philadelphia, red tail, second premium,	75
Mark Schofield, Philadelphia, yellow tail, first premium,	1 00
Mark Schofield, Philadelphia, blue wing, second premium,	75

Swallows.

John Yerkes, Philadelphia, black, second premium,	75
John Yerkes, yellow, first premium,	1 00
John Yerkes, yellow, second premium,	75
W. H. Ehringer, Philadelphia, blue, first premium,	1 00
W. H. Ehringer, red, first premium,	1 00
John Yerkes, blue, second premium,	75
John Yerkes, blue, with bars, second premium,	75
Martin Hoepfner, blue, with white bars, first premium,	1 00
Martin Hoepfner, blue, with black bars, first premium,	1 00
H. W. Vahle, Philadelphia, black, white bars, first premium,	1 00
H. W. Vahle, black, first premium,	1 00
H. W. Vahle, red, first premium,	1 00
H. W. Vahle, red, with no bars, second premium,	75

Magpies.

W. H. Ehringer, crested, second premium,	75
W. H. Ehringer, red, first premium,	1 00
W. H. Ehringer, red, second premium,	75
W. H. Ehringer, black, first premium,	1 00
W. H. Ehringer, black, second premium,	70
W. H. Ehsinger, black, plain, first premium,	1 05
H. W. Vahle, yellow, plain, first premium,	1 00

Moore.

J. A. Stovell, Philadelphia, blue, first premium,	1 00
Martin Hoepfner, blue, first premium,	1 00

Jacobins.

H. W. Vahle, white, first premium,	$1 00

Snells.

W. H. Ehrlinger, blue tail,	1 00
W. H. Ehrlinger, black tail,	1 00

Barbs.

W. H. Ehringer, white, first premium,	1 00
Mark Schofield, white, second premium,	75

Owls.

W. H. Ehringer, blue powdered, first premium,	1 00
W. H. Ehringer, blue muffed, second premium,	75
Mark Schofield, silver, second premium,	75
J. G. Darlington, blue muffed, second premium,	75
Mark Schofield, blue tail, first premium,	1 00
J. A. Stovell, blue muffed, second premium,	75
J. A. Stovell, silver, first premium,	1 00
J. A. Stovell, blue powdered, second premium,	75
J. A. Stovell, red check, first premium,	1 00
J. A. Stovell, yellow check, first premium,	1 00
J. A. Stovell, white check, first premium,	1 00
J. A. Stovell, white check, second premium,	75
J. A. Stovell, blue check, second premium,	75

Dragons.

W. H. Ehrlinger, white, second premium,	75
W. H. Ehrlinger, yellow, first premium,	1 00
W. H. Ehrlinger, red, first premium,	1 00
W. H. Ehrlinger, blue, first premium,	1 00
W. H. Ehrlinger, silver, first premium,	1 00
F. F. Kampe, white, first premium,	1 00

Frillbacks.

H. W. Vahle, white, second premium,	75
H. W. Vahle, silver, first premium,	1 00

Tumblers.

W. H. Ehrlinger, red ball, first premium,	1 00
W. H. Ehrlinger, blue ball, second premium,	75
Martin Hoepfner, black beard, first premium,	1 00
Mark Schofield, black mottled, first premium,	1 00
H. W. Vahle, blue booted,	1 00
J. A. Stovell, yellow booted, first premium,	1 00
J. A. Stovell, yellow booted, second premium,	75
J. A. Stovell, red booted, first premium,	1 00
J. A. Stovell, red booted, second premium,	75
H. W. Vahle, red beards, first premium,	1 00
H. W. Vahle, blue beards, first premium,	1 00

Fantails.

H. W. Vahle, white, second premium,	75
H. W. Vahle, red, first premium,	1 00

H. W. Vahle, blue, first premium,	$1 00
H. W. Vahle, dun, first premium,	1 00
H. W. Vahle, black, second premium	75
F. F. Kampe, white, first premium	1 00
F. F. Kampe, black, first premium,	1 00

Panters.

F. F. Kampe, blue, first premium,	1 00
F. F. Kampe, white, first premium,	1 00
Martin Hoepfner, Blue Quakers, white bars, first premium,	1 00
H. W. Vahle, Blue Quakers, white bars, first premium,	1 00
H. W. Vahle, coppers, first premium,	1 00
Mark Schofield, Starting Quakers, second premium,	75
J. A. Stovall, Starting Quakers, first premium,	1 00

Antwerps.

J. A. Stovell, white, first premium,	1 00
J. A. Stovell, white, second premium,	75
J. A. Stovell, black, first premium,	1 00
B. F. Lewis, red check, first premium,	1 00
B. F. Lewis, silver, second premium,	75
B. F. Lewis, blue, second premium,	75
W. S. Harbison, Camden, N. J., dun, first premium,	1 00
W. S. Harbison, blue, first premium,	1 00
W. S. Harbison, red, second premium,	75
W. T. Harbison, silver black bars, first premium,	1 00
W. B. Harbison, blue check, second premium,	75

Dutchies.

F. F. Kampe, white, first premium,	1 00
F. F. Kampe, white, second premium,	75
Martin Hoepfner, spangled ice, first premium,	1 00
Martin Hoepfner, blue white bars, first premium,	1 00
Martin Hoepfner, black priests, white bars, first premium,	1 00
Martin Hoepfner, blue Brunswicks, first premium,	1 00
Martin Hoepfner, blue spangled shields, first premium,	1 00
Martin Hoepfner, red spangled white bars, first premium,	1 00
Martin Hoepfner, bald head trumpeters, first premium,	1 00
H. W. Vahle, ice, second premium,	75
H. W. Vahle, blue runts, first premium,	1 00
H. W. Vahle, black runts, first premium,	1 00

Ornamental and Caged Birds.

H. W. Vahle, mocking bird,	1 00
H. W. Vahle, English thrush.	1 00
H. W. Vahle, English blackbird,	1 00
H. W. Vahle, English sterling,	1 00
H. W. Vahle, English nightingale,	1 00
H. W. Vahle, English skylark,	1 00
H. W. Vahle, English robin,	1 00
H. W. Vahle, American robin,	1 00
H. W. Vahle, white robin.	1 00
H. W. Vahle, American blue jay,	1 00
H. W. Vahle, thresher,	1 00

W. TABLE,
WM. A. WERT,
Committee.

RABBITS.

Joseph Spencer, Philadelphia, Madagascar fawn buck, . . .	$0 50
Joseph Spencer, Madagascar fawn doe, ...	50
Joseph Spencer, Madagascar mottled buck, ...	50
Joseph Spencer, Madagascar mottled doe, ...	50

BEES.

Colony Italian bees.

H. M. Twining, Philadelphia, first premium, ...	$5 00
Thomas Paddison, Philadelphia, ...	Diploma.

Cyprian.

S. W. Morrison, Oxford, first premium, ...	$5 00

Syrian.

Arthur Todd, Philadelphia, first premium, ...	5 00

Carniolan.

S. W. Morrison, Oxford, first premium, ...	5 00

Native or Black.

H. M. Twining, Philadelphia, first premium, ...	5 00

Queen rearing.

H. M. Twining, Philadelphia, first premium, ...	5 00
Arthur Todd, Philadelphia, ...	Diploma.

Queen cells.

Arthur Todd, Philadelphia, first premium, ...	$5 00

Queen bees, any race.

S. W. Morrison, Oxford, first premium, ...	5 00

HONEY AND WAX.

Comb honey, collection.

I. G. Whitten, Geneva, New York, ...	Diploma.
Moddle Bee Hive Company, Philadelphia, ...	Diploma.

Comb honey, ten pounds, best.

Moddle Bee Hive Company, Philadelphia, ...	Diploma.

Extracted honey, coll.

Moddle Bee Hive Company, Philadelphia, ...	Diploma.

Extracted honey, ten pounds, best.

E. J. Baxter, Nawes, Illinois, ...	Diploma.

Honey, best and largest collection.

Arthur Todd, Philadelphia, ...	Diploma.

HIVES AND APPLIANCES.

Movable frame hive.

Arthur Todd, Philadelphia, ...	Diploma.

Straw hive.

Arthur Todd, Philadelphia, ... Diploma.

Apiarian tools.

Arthur Todd, Philadeiphia, ... Diploma.

A very extensive and fine collection, for which he deserves great credit.

Reversible frame.

Arthur Todd, Philadelphia, ... Diploma.

Collection Comb Foundation.

Charles Dadant, Hamilton, Illinois, ... Diploma.

Honey racks.

F. Dauzenbaker, Claymont, Delaware, ... Diploma.

New invention.

Arthur Todd, Philadelphia, ... Diploma.

MANIPULATION.

Transferring.

Arthur Todd, Philadelphia, first premium, ... $5 00
H. M. Twining, Philadelphia, ... Diploma.

Manipulation,

Arthur Todd, Philadelphia, first premium, ... $5 00
H. M. Twining, Philadelphia, ... Diploma.

Extraction of honey.

Arthur Todd, Philadelphia, first premium, ... $5 00
H. M. Twining, Philadelphia, ... Diploma.

I respectfully submit the above as my report.

J. HASBROUCH,
New Brunswick, N. J.

CLASS No. 41—GRAIN AND SEEDS, AND VEGETABLES.

Competing Societies—Best and Largest Collection.

D. H. Branson, first premium, ... $30 00

CLASS No. 43.

Yellow Corn—Six Bushels.

D. H. Branson, first premium, ... 5 00

White Flint Corn—Six Bushels.

D. H. Branson, first premium, ... 5 00

Oats—Six Bushels.

D. H. Branson, first premium, ... 5 00

CLASS No. 44.

White Wheat.

Baker, Rowell & Co., Easton, Md., first premium, ... $3 00

Fultz Wheat.

Baker, Rowell & Co., Easton, Md., first premium, ... 3 00

Red Wheat.

Baker, Rowell & Co., Longberry variety, first premium, . . 3 00
W. H. Smith, Phila., Longberry variety, second premium, . . 2 00

Red Wheat, direct from original importation.

H. W. Monte, Philadelphia, first premium, ... 3 00

GRAIN AND SEEDS—DISPLAY WHEAT AND A SHEAF.

J. M. & R. C. Kaighn, Camden, N. J., first premium, ... 5 00

Yellow Corn.

James Cloud, Oxford, Pa., first premium, ... 2 00

Indian Corn—Yellow Gourd Seed.

D. H. Branson, first premium, ... 2 00
James Cloud, Oxford, Pa., second premium, ... 1 00

White Gourd Seed.

James Cloud, first premium, ... 2 00
D. H. Branson, second premium, ... 1 00

Yellow Flint.

D. H. Branson, first premium, ... 2 00
James Cloud, second premium, ... 1 00

White Flint.

D. H. Branson, first premium, ... 2 00

Field Corn.

D. H. Branson, first premium, ... 3 00
J. M. & R. C. Kaighn, second premium, ... 2 00

Collection, ten or more variety, stalks.

D. H. Branson, first premium, ... 5 00
James Cloud, second premium, ... 3 00

GRAIN AND SEEDS.

White Oats—Six bushels.

D. H. Branson, first premium, ... 2 00

Sheaf of Oats.

D. H. Branson, first premium, ... 2 00

Broom Corn.

D. H. Branson, first premium, ... 3 00

Sheaf of Millet.

Baker, Rowell & Co., Easton, Md., first premium, ... $3 00

Sunflower.

D. H. Branson, first premium, ... 2 00

Having carefully examined the entries in this book, we make the foregoing award of premiums.

WM. H. HOLSTEIN,
JAMES R. PIPER.

SUB-CLASS 45c—POTATOES.

Collection of fifty varieties.

George D. Field, first premium, ... $10 00
J. M. & R. C. Kaighn, second premium, ... 5 00

Collection of twenty varieties.

J. M. & R. C. Kaighn, first premium, ... 5 00

Collection of five varieties.

J. M. & R. C. Kaighn, first premium, ... 5 00

Collection of American Seedlings.

J. M. & R. C. Kaighn, first premium, ... 5 00

Sweet Potatoes—Red.

George M. Rogers, first premium, ... 2 00
George D. Field, second premium, ... 1 00

Sweet Potatoes—Yellow.

George D. Field, first premium, ... 2 00
George M. Rogers, second premium, ... 1 00

Yams—one half bushel.

George D. Field, first premium, ... 2 00
George M. Rogers, second premium, ... 1 00

ONIONS.

White Flat.

D. H. Branson, first premium, ... 2 00
George D. Field, second premium 1 00

White Round.

George D. Field, first premium 2 00

Red Flat.

D. H. Branson, first premium 2 00
George D. Field, second premium 1 00

Yellow Flat.

George D. Field, first premium 2 00

Yellow Round.

George D. Field. first premium 2 00

Collection Foreign.

George D. Field, first premium, ... 2 00

General Collection.

George D. Field, first premium 5 00

DISPLAY CATTLE-FEEDING ROOTS.

George D. Field, first premium 10 00

TURNIPS, TABLE USE.

George D. Field, first premium 2 00

PARSNIPS, LONG VARIETY.

J. M. & R. C. Kaighn, first premium 2 00
D. H. Branson, second premium 1 00

SALSIFY.

George D. Field, first premium 2 00

To the President and Managers of the Pennsylvania State Agricultural Society:

We find the general display fair, especially the potatoes, though some few articles were not deemed worthy the premiums offered.

Your committee recommend that hereafter all articles competing for the same premium be grouped together. This plan would not only greatly simplify the work of the judges, but also enable visitors to make comparisons for themselves.

Respectfully submitted,

JOHN MCDOWELL,
H. C. DEMMING,
THOMAS J. EDGE.

CLASS 46.—GRASSES AND GREEN VEGETABLES.

COLLECTION GREEN VEGETABLES.

J. M. & R. C. Kaighn, Camden, first premium, . . $10 and Report.

GRASSES—DRIED FORAGE PLANTS.

J. M. & R. C. Kaighn, first premium, ... 3 00

DISPLAY OF GROWING IN POTS.

George W. Field, first premium 5 00

DISPLAY CUCURBITACEOUS VEGETABLES.

George D. Field, first premium 10 00

WATERMELON COLLECTION.

George M. Rogers, first premium 10 00
George D. Fields, second premium 5 00

Most Perfect in Color, Texture and Flavor.

George D. Field, first premium 3 00

Oblong, Dark Skinned.

George D. Field, first premium 2 00

CANTELOUPES—COLLECTION.

George D. Field, first premium 10 00
D. H. Branson, second premium 5 00

Three Globular—Green.

George D. Field, first premium 2 00

Three Oblong.

George D. Field, first premium 2 00

Three Oblong, Orange.

D. H. Branson, first premium 2 00

Heaviest Canteloupe.

George D. Field, first premium 2 00

SQUASHES.

Summer Collection.

J. M. &. R. C. Kaighn, first premium 2 00
George D. Field, second premium 1 00

Twelve Specimens, Three Varities.

George D. Field, first premium 2 00

Summer, Foreign Varieties.

George D. Field, first premium 2 00

Winter Collection.

George D. Field, first premium 2 00
George M. Rogers, second premium 1 00

Twelve Specimens, Three Varieties.

George D. Field, first premium 2 00

PUMPKINS.

Nine Specimens, Three Varieties.

D. H. Branson, first premium 2 00
George D. Field, second premium 1 00

Foreign Variety.

J. M. & R. C. Kaighn, first premium 3 00

GOURDS—COLLECTION.

George D. Field, first premium 2 00

ASPARAGUS.

George D. Field, first premium 2 00

BROCCOLI.

George D. Field, first premium 3 00

BEANS.

George M. Rogers, "Lima," first premium $2 00
George D. Field, "American Bush," second premium . . . 1 00

American Pole.

George D. Field, first premium 2 00

Foreign.

George D. Field, first premium 2 00

CABBAGE.

Flat Heads.

George M. Rogers, first premium 2 00
George D. Field, second premium 1 00

Conical Heads.

Geo. D. Field, first premium, ... 2 00

Savoys.

Geo. D. Field, first premium, ... 2 00

Collection Cabbage.

Geo. D. Field, first premium, ... 3 00

CELERY.

Dwarf White.

Geo. D. Field, first premium, ... 2 00

Tall White.

Geo. D. Field, first premium, ... 2 00

Red.

Geo. D. Field, first premium, ... 2 00

EGG PLANT.

Long Round Purple.

Geo. D. Field, first premium, ... 3 00
Geo. M. Rogers, second premium, ... 2 00

KOHL RABI.

Geo. D. Field, first premium, ... 2 00

LETTUCE.

White Cabbage Variety.

Geo. D. Field, first premium, ... 2 00

Coss Variety.

Geo. D. Field, first premium, ... 2 00

OKRA.

J. M. & R. C. Kaighn, first premium, ... 2 00
Geo. D. Field, second premium, ... 1 00

PEPPERS.

Geo. D. Field, first premium, ... $2 00

Bell Nose.

Jno. Sherer, first premium, ... 2 00
D. H. Branson, second premium, ... 1 00

New Variety.

Geo. D. Field, first premium, ... 2 00

SPINACH.

Geo. D. Field, first premium, ... 2 00

TOMATOES.

Dish.

Geo. M. Rogers, first premium, ... 2 00
D. H. Branson, second premium, ... 1 00

Collection.

Geo. D. Field, first premium, ... 5 00

Mr. President and gentlemen of the Pennsylvania State Agricultural Society: Your committee in Class 46, grapes and green vegetables, respectfully report the rewards to the person entitled in our judgment, having due regard to the merits of the articles, would also make honorable mention of box of cranberries exhibited by E. C. Crow, New Jersey. These cranberries were raised on cultivated land, are exceedingly fine, plump and very large.

JOHN MCDOWELL,
HATTIE R. PHILIPS,
LAURA V. HORN.

CLASS 47.—PLUMS.

Collection.

George D. Field, second premium, ... $5 00

GENERAL ASSORTMENT FRUIT.

William Parry, Parry, New Jersey, second premium, . . . 10 00

NATIVE GRAPES.

Sixty varieties.

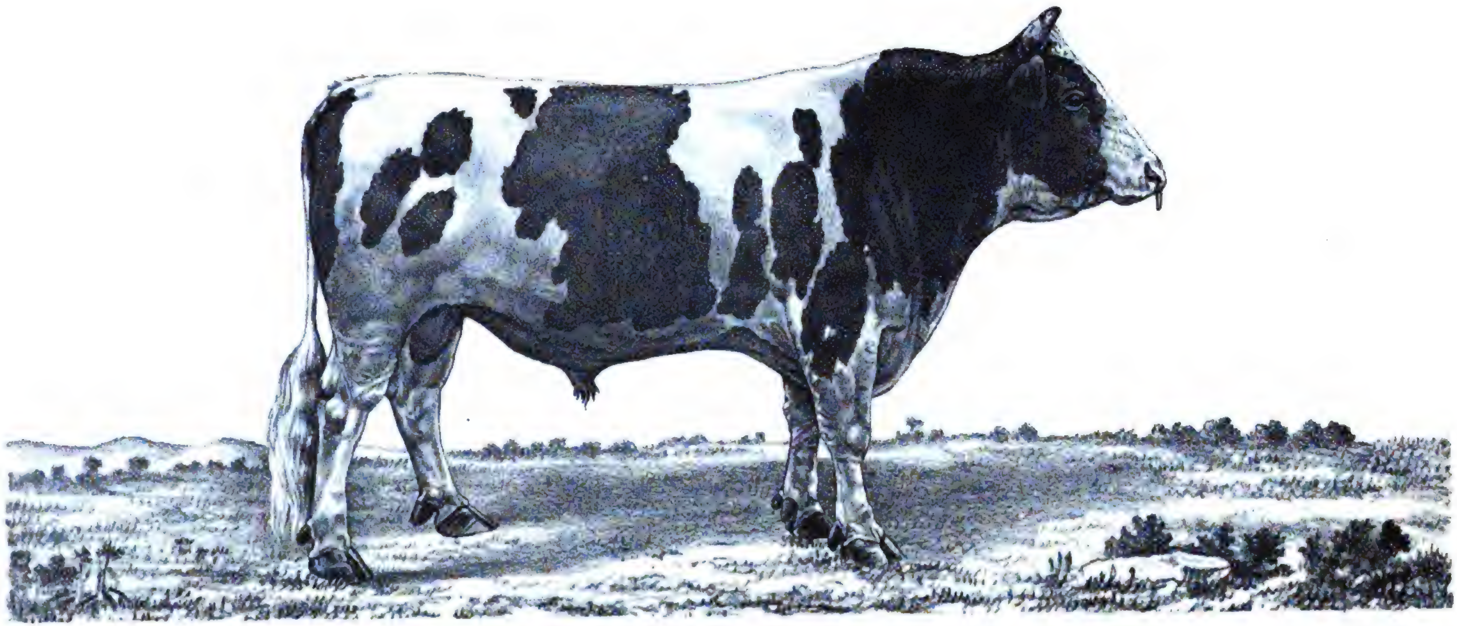
Joel Horner & Son, Merchantville, New Jersey, first premium, ... 30 00

Thirty varieties.

Joel Horner & Son, first premium, ... 15 00
William Parry, second premium, ... 10 00

Collection, twenty varieties.

Joel Horner & Son, first premium, ... 10 00
William Parry, second premium, ... 5 00



MOOIE SJOERD.

HOLSTEIN BULL.—WINNER FIRST PRIZE PENNSYLVANIA STATE FAIR, 1885, BETWEEN 2 AND 3 YEARS.
" " " 1887, OVER 3 YEARS OLD.
OWNED BY LACKAWANNA BREEDERS' ASSOCIATION, WAVERLY, PA.

Collection, ten varieties.

Joel Horner & Son, first premium,	$5 00
William Parry, second premium,	3 00

GRAPES

Concord.

William Parry, first premium,	2 00
George D. Field, second premium,	1 00

Martha.

William Parry, first premium,	2 00
Joel Horner & Son, second premium,	1 00

Clinton.

Joel Horner, first premium,	2 00

Niagara.

William Parry, first premium,	2 00
J. W. Cox, second premium,	1 00

Brighton.

Joel Horner & Son, first premium,	2 00
William Parry, second premium,	1 00

Delaware.

Joel Horner & Son, second premium,	1 00

Rogers' Hybrids.

Joel Horner & Son, second premium,	1 00

Any new variety.

William Parry, first premium,	2 00
Joel Horner & Son, second premium,	1 00

Any new hardy variety.

William Parry, first premium,	2 00
Joel Horner & Son, second premium,	1 00

PEACHES.

Collection ten varieties.

William Parry, second premium,	5 00

Late Crawford.

P. C. Hiller, first premium,	2 00
John Sherer, second premium,	1 00

Reeves' Favorite.

William Parry, second premium,	1 00

Ward's Late.

William Parry, second premium,	2 00

Smock.

William Parry, second premium,	1 00

Solway's.

William Parry, second premium, ... $1 00

Any new variety.

Annie W. Carwether, first premium, ... 2 00
William Parry, second premium, ... 1 00

Basket, six varieties.

P. C. Hiller, second premium, ... 2 00

General collection.

William Parry, second premium, ... 10 00

PEARS.

Collection, largest.

William Parry, first premium, ... 20 00

Collection fifty varieties.

William Parry, second premium, ... 10 00

Collection twenty varieties.

P. C. Hiller, first premium, ... 10 00
William Parry, second premium, ... 5 00

Collection ten varieties.

William Parry, second premium, ... 3 00

Bartlett.

D. Colwell, Hammonton, New Jersey, first premium, . . . 2 00
J. M. & R. C. Kaighn, second premium, ... 1 00

Seckel.

J. M. & R. C. Kaighn, first premium, ... 2 00
William Parry, second premium, ... 1 00

Beurre d Anjou.

D. Colwell, first premium, ... 2 00
William Parry, second premium, ... 1 00

Lawrence.

J. M. & R. C. Kaighn, first premium, ... 2 00
D. Colwell, second premium, ... 1 00
L. Monford, second premium, ... 1 00

Sheldon.

J. M. & R. C. Kaighn, first premium, ... 2 00
William Parry, second premium, ... 1 00

Belle Lucrative.

William Parry, second premium, ... 1 00

Howell.

William Parry, second premium, ... 1 00

Duchesse d'Angouleme.

D. Colwell, first premium,	$2 00
L. Monfort, second premium,	1 00

Louise Bonne.

J. M. & R. C. Kaighn, first premium,	2 00

Winter Nelis.

William Parry, first premium,	2 00
J. M. & R. C. Kaighn, second premium,	1 00

Any other variety.

William Parry, "Laconto," first premium,	2 00
L. Monfort, "Kieffer," second premium,	1 00

Six Fall varieties.

J. M. & R. C. Kaighn, first premium,	3 00
William Parry, second premium,	2 00

Six Winter varieties.

William Parry, first premium,	3 00
J. M. & R. C. Kaighn, second premium,	2 00

Basket.

P. C. Hiller, first premium,	5 00
J. M. & R. C. Kaighn, second premium,	2 00

APPLES.

Best collection—twenty-five varieties.

P. C. Hiller, first premium,	20 00
John Sherer, second premium,	10 00

Best collection—ten varieties.

William Parry, first premium,	10 00
P. C. Hiller, second premium,	5 00

Baldwin.

William Parry, first premium,	2 00
John Sherer, second premium,	1 00

Smith's Cider.

William Parry, first premium,	2 00

Rhode Island Greening.

J. M. & R. C. Kaighn, first premium,	2 00
John Sherer, second premium,	1 00

King of Tompkin's County.

William Parry, second premium,	1 00

Smokehouse.

William Parry, first premium,	2 00
J. Sherer, second premium,	1 00

Maiden's Blush.

John Sherer, first premium, ...	$2 00
William Parry, second premium, ...	1 00

Pound.

John Sherer, first premium, ...	2 00

Golden Russett.

William Parry, first premium, ...	2 00

Hubbardston Nonsuch.

William Parry, first premium, ...	2 00

Porter.

P. C. Hiller, first premium, ...	2 00
William Parry, second premium, ...	1 00

Any other variety.

D. Colwell, "Ben Davis," first premium, ...	2 00
William Parry, "French Pippin," second premium, ...	1 00

Six Fall varieties.

William Parry, first premium.	5 00
J. M. & R. C. Kaighn, second premium, ...	2 00

Six Winter varieties.

J. M. & R. C. Kaighn, first premium, ...	5 00
William Parry, second premium, ...	2 00

Basket of Apples.

P. C. Hiller, first premium, ...	5 00
J. M. & R. C. Kaighn, second premium, ...	2 00

QUINCES—BEST COLLECTION.

William Parry, first premium, ...	5 00
J. M. & R. C. Kaighn, second premium, ...	2 00

In addition to the above, the committee would call the attention of the Board to an exhibit, by William Parry & Son, of fifteen dishes of Oriental pears as worthy of mention.

Respectfully submitted.

GEO. D. STITZEL,
GAB. HIESTER.

CLASS 49—FARINACEOUS PRODUCTS.

Barrel Flour, from Winter Wheat.

George Hecker & Company, 49, North Water street, Philadelphia, ... Report

Wheat—Buckwheat.

George Hecker & Company, ... Report.

Creamery Buttered Flour

Brunswick Manufacturing Company, 235, North Front street, Philadelphia, ... Report.

CLASS 52—CIGARS.

Gray, Morcles & Dutton, 514 Pine street, Philadelphia, ... Bronze Medal.

Show the entire process of manufacturing cigars from Havana tobacco by eight Cuban cigarmakers, this display was very extensive and meritorious, and their cigars of the highest character for purity and excellence and workmanship.

Your committee takes much pleasure in awarding them a bronze medal.

NATIVE WINES.

Collection.

Julius Hinckes, Egg Harbor City, New Jersey, first premium, ... Diploma.

Blackberry Wine.

John Locks, ... Very meritorious.

Orange Wines.

Florida Wine Company, 1207 Market street, Philadelphia, first premium, ... Diploma.

Very excellent quallty, and a new brand, with little alchol. A fine snmmer drink.

We beg leave to report that whilst the exhibit made by John Locke, blackberry and orange wines were very meritorious, those made by Julius Hincks, of Egg Harbor, not only equaled, but far surpassed his previous record for the manufacturing of pure and excellent wines, for which the committee and Society can fully indorse.

D. H. BRANSON,
D. W SEILER.

Victoria Regia Plant in Bloom—Wardian case.

Christian Eisele, 1502, North Eleventh street, Philadelphia, first premium, ... $15 00

Hanging Baskets.

Christian Eisele, 1502, North Eleventh street, Philadelphia, first premium, ... 3 00

CLASS 55.—DESIGN ORNAMENTAL DRIED GRASSES.

LaRoche & Stahl, Thirteenth and Chesnut streets, Philadelphia, first premium, ... 5 00

CUT FLOWERS.

General collection named.

Christian Eisele, first premium, ... 10 00
Oscar R. Krinberg, second premium, ... 5 00

Special Premium—"Dranthus" Pink.

Oscar R. Krinberg, ... 2 00

Double Dahlias.

H. A. Dreer, 714 Chestnut street, Philadelphia, first premium, ... $3 00

Geraniums.

H. A. Dreer, first premium, ... 3 00

Gladiolus.

H. A. Dreer, first premium, ... 3 00

Verbenas.

H. A. Dreer, first premium, ... 3 00

Petunias.

H. A. Dreer, first premium, ... 3 00

Phlox Herbaceous.

H. A. Dreer, first premium, ... 3 00

China Astors

Mrs. E. D. Demerest, first premium, ... 3 00
Christian Eisele, second premium, ... 2 00
Oscar R. Kreinbery, special, ... 1 00

Large Design—Cut Flowers.

Hugh Graham & Co., first premium, ... 50 00
Christian Eisele, second premium, ... 30 00
LaRoche & Stahl, third premium, ... 20 00

ARNOLD LOMEL,
H. C. BOWELS,
L. MOHMAN.

FUNERAL EMBLEMS.

Wreath, Fourteen-inch Frame.

LaRoche & Stahl, first premium, ... $5 00

Cross, eighteen-inch frame.

La Roche & Stahl, second premium, ... 3 00

Anchor, eighteen-inch frame.

T. P. Warnock, second premium, ... 3 00

ARNOLD LOMEL,
H. C. BOWLES,
LOUIS J. EAGLE,
Committee.

CLASS 56—TRANSPORTATION.

Cart.

Samuel Ulrich, Reading, Pennsylvania, exhibits a very fine cart, well made and easily dumped.

Brick Wagon.

P. S. Weare, 536 Diamond street, Philadelphia. The Star brick wagon model exhibited by P. S. Weare, Philadelphia, is an excellent arrangement for the saving of brick from breaking, as the bed is easily shifted back and held at any angle or let down on the ground without the least jar. The end-gate rises on its hinges at the will of the driver and the bricks are unloaded as the wagon is drawn away. It deserves honorable mention.

Truck and covered wagon.

Fulton & Walker Company, Twentieth and Filbert streets, Philadelphia, ... First Report.

Six spring double bearing top wagon.

Pabest & Logendorfer, 1310 Germantown, ... First Report.

Hay wagon.

Barton Manufacturing Company exhibit a hay wagon having broad tires; workmanship is very fine and the arrangements for conveniences is very complete for farm purposes.

Sprinkling wagon.

The patent centrifugal water sprinkler, exhibited by Robert Exley, 1525 Allegheny avenue, Philadelphia, a new machine and will commend itself to all at sight. The principle on which it works is simple and effective. The water is easily regulated, as also the space or distance sprinkled. The fans can be used separately or together shutting the water off. They are put in motion by a ratchet lock in the hub of the wagon wheel, ... Diploma.

CLASS 57.

Phætons, etc.

To McLear & Kendall, 206 North Broad street, Philadelphia, was given first premium for two phætons and also to same firm first premium for carriage. The Philadelphia S. S. Phæton Company exhibit a jump seat for carriages that works well, but we do not commend the work as worthy of premium.

Buggies.

A diploma was awarded to Edward Edgerly, Lancaster, Pennsylvania, for buggies, and second to M. L. Landis, Lansdale, Pennsylvania.

Hay wagon.

The farm wagon exhibited by Edward Neal, of Jarrettstown, Pennsylvania is strong yet light; steel spindles and no farmer can make a mistake in buying one.

Express.

George Lingert and Feelton & Walker, we deem worthy of first premiums.

Dearborn wagons.

The first premium was awarded to J. Rech & Son for a Dearborn milk wagon and also for a side-door milk wagon.

Coach.

To Fulton, Walker & Company, Twentieth and Filbert street, Philadelphia, the first premium was awarded for coaches and second premium to McLear & Kendell, 216 North Broad street, Philadelphia.

Wagon jacks.

The first premium in wagon jacks was awarded to George M. Reeser, Bird-in-Hand, Pennsylvania, and second premium to J. Wilson Heald, Fifteenth and Fairmount avenue, Philadelphia.

Push cart.

First premium to Ketterer & Georger, 1517 North Twenty-first street, Philadelphia, for push cart.

We have examined all the works in above classes and have set opposite the names of exhibitors the awards we have given them.

EDWARD CADWALADER,
J. J. JACKSON, M. D.

AGRICULTURAL IMPLEMENTS.

The American hay maker, established by Israel L. Landis, of Lancaster, Pa., is a combined hay rake and tedder, and has several devices for convenience to the operator as well as for quickly replacing a broken tooth.

The Combined raker and tedder exhibited by the Rake and Tedder Company of Lancaster, Pa., is well arranged and showed advantages in its working both as a tedder and raker.

The New York Champion horse dump rake, exhibited by Patton, Stafford & Myers, Canastata, N. Y., is an entirely new implement to all appearances, and from its working is very worthy of favorable mention.

GROUP XVII—Miscellaneous.

GRINDING MILLS.

S. L. Wilson & Co., 223 North Broad street, Philadelphia, were awarded a diploma for grinding mills.

A. W. Straub, 3537 Filbert street, Philadelphia, grinding mills, a diploma.

FEED CUTTERS.

For feed cutters a diploma was awarded to S. L. Wilson & Co., 223 North Broad street, Philadelphia.

Thos. G. Snedly, Williston, Pa., hay cutter, very meritorious.

John Laughlen, York, Pa., Eclipse hay, straw and fodder cutter, very good report.

ATWATER GRAIN SCALES.

A very ingenious device for weighing grain and worthy a diploma.

Cider Mills.

The Bartun Manufacturing Company, 338 North Water street, Philadelphia, exhibited cider mills in operation, and merit a report.

Cream Separators.

The Backerstow cream separator, exhibited by S. L. Wilson & Co., 223 North Broad street, Philadelphia, is a superior machine, and is worthy a diploma, as are the Vert hand and horizontal separators exhibited by P. M. Sharpless, of West Chester, Pa.

Bag Holder.

Exhibited by S. L. Worrell, of 1421 Bouveir street, Philadelphia, is a very good device and merits a report,

The portable wire and wood fence making machine exhibited by the Empire Machine Company of Richmond, Indiana, is good, and we recommed a diploma.

Gentlemen of the Pennsylvania State Agricultural Society:

Your commitee, having examined the entries in Group 17, Class 58, would most respectfully report as marked opposite the respective exhibits.

D. H. Branson,
Jas. R. Piper.

CLASS 69—Horse Shoes.

J. J. Known, 3809 Lancaster avenue, Philadelphia, exhibited hand-made horse shoes of unusual excellence and should be awarded the report.

W. E. Heidman, 1010 North Fourth street, Philadelphia, shows a meritorious lot of hand-made horse shoes and William Mills a case of English hand-made horse shoes of superior finish.

Thomas J. Andress, 821 Cherry street, Philadelphia, exhibited a large and deserving collection of household hardware novelties, all serviceable and labor-saving—Report.

Saddlery and Hardware.

A fine exhibit by Patrick McFadden, 2144 North Broad street, Philadelphia. The only exhibit of the kind here and deserving special mention.

Railroad Supplies.

An extensive and well-arranged collection of railroad, miners' and engineers' supplies, which your committee commend, was exhibited by T. B. Bickerstar, South Fourth street, Philadelphia.

CLASS 70—Engines.

S. L. Wilson & Co., 223 North Broad street, Philadelphia, exhibited two portable engines worthy a report.

The Ide automatic engine, exhibited by the foundry and machine department of the Harrisburg Car Manufacturing Company, Harrisburg, Pennsylvania, furnished power for agricultural hall, running three hundred and seventy-five feet of shafting, never causing a stop,

and proved itself a first-class engine by actual test in both economy and finish.

The steam engine and boiler exhibited by H. M. Sciple, Third and Arch streets, Philadelphia, is a finely-finished piece of work.

No opportunity was given to test the merits of the traction engines exhibited by the Geiser Manufacturing Company, of Waynesboro', Pennsylvania, and by the foundry and machine department of the Harrisburg Car Company, but from what the committee can see each one has its respective good and serviceable qualities.

Favorable mention is made of the steam rammer for street paving exhibited by John G. Schmidt, 2901 Kensington avenue, Philadelphia.

The Shipman oil burning engine, exhibited by S. L. Wilson, 223 North Broad street, Philadelphia, being perfectly automatic in all its operations, is first class for farmers and inexperienced persons.

The spring motor for running sewing machines is exhibited by the Sewing Machine Motor Company, 614 Arch street, Philadelphia, is the best motor your committee has ever seen for the purpose, and it will prove of great benefit to those using it in connection with sewing machines.

CLASS 71.

William Heaton, 503 Chestnut street, Philadelphia, exhibited a line of leather belting worthy of a report.

The above is the report of your committee.

W. B. TILL.
B. P. THOMPSON.

CLASS 74.

Gentlemen of the Pennsylvania State Agricultural Society :

Your committee, having examined all the entries in Group twenty-one, Class seventy-four, beg leave to submit the following as a result of a careful examination of all the entries contained therein :

The exhibit made by E. & F. Gleason is one of the attrative features of the exhibition, consisting of surfacing and jointing machine, patent reversible tilting saw and band saw, as also exhibit made by Walters & Sons, consisting of scroll saw, mortise, square hole boring machine, &c. Bordsall & Sons exhibit a splendid line of pumps. The glass or patent valve used by this party is deserving of much merit, as also is the liquid pumping machine, of four different varieties, durable in its design and very meritorious

D. H. BRANSON, *Committee.*

CLASS 75—GRINDSTONES.

We would make honorable mention of the lot of grindstones on exhibition by J. E. Mitchell, 310 York avenue, Philadelphia.

LATHES.

The exhibition of a large number or lathes of different sizes by W. P. Walters & Sons, 1223 Market street, Philadelphia, was very fine, the machines being neat in finish and well adapted to all kinds of work, and the exhibit merits the commendation of the Society.

The planing machine exhibited by E. & F. Glesson, American and

Susquehanna streets, Philadelphia, is admirably adapted to its work, is entirely new, having a large screw underneath that the operator can readily use to adjust the thickness desired, and it also steadies the support against any racking of the table. It is without doubt a valuable improvement.

WIRE MACHINES.

The Cambria link barb wire machine exhibited by the Cambria Iron Works, Johnstown, proves its practical utility by its operation in the main building, turning out a neat link chain suitable for strong and safe fence, its links making it pliable and easily handled and the barbs are short, but sufficiently long to turn stock. It will commend itself to all.

The following statements referring to exhibitors are respectfully submitted.

JNO. McDOWELL, *Committee.*

CLASS 78.

The Button sewing machine, exhibited by George A. Smith, 17 South Fourth street, Philadelphia, is very meritorious, ... A Report.

The exhibit of F. D. Weglman, 426 Market street, Philadelphia, manufacturing shoes, was very good, ... A Report.

The Automatic shoe beader, exhibited by the Wheeler & Wilson Manufacturing Company, is a very ingenious invention, and meritorious, ... A Report.

The "Automatic shoe cleaner and shaper," and "the seam trimmer," exhibited by Wheeler & Wilson Manufacturing Company, are very meritorious, ... A Report.

CLASS 79.

The "button making machine," exhibited by Partridge & Richardson, North Eighth street, Philadelphia, is a very ingenious and meritorious exhibit, ... A Report.

Ricketts & Prince, Howard street, Philadelphia, weaving machine, ... A Report.

Partridge & Richardson, Philadelphia, fringe machine, making forty different styles and shapes, was a very interesting and valuable exhibit, and deserves very liberal mention.

Mr. President and Gentlemen of the Pennsylvania Agricultural Society:

Your committee appointed to examine the entries in Group 23 and Class 78 and 79, beg leave to report that all the entries in these classes were of superior excellence. The various entries by the Wheeler & Wilson Manufacturing Company, all did their work well, and reflected credit not only to themselves but to the Society, as also did the entries made by Partridge & Richardson and Ricketts & Prince.

All of which is most respectfully submitted.

D. H. BRANSON,
Committee.

CLASS 80.

Mr. President and Gentlemen of the Pennsylvania State Agricultural Society:

The Electro-Medical and Surgical Apparatus manufactured by Otto Fleming, 1009 Arch street, Philadelphia, in Class 80 and Group 25, are:

1. New invention of a Galvano-Cantery battery and burners for operations in nose, throat and ear diseases, removing of tumors, &c., by incandescent instruments.
2. New improvement in portable galvanic batteries combined with Faradic induction currents.
3. New improvement in portable Fardic batteries, provided with slow and rapid interrupter.
4. Improved electro-therapeutic apparatus for physicians' office use—not portable.
5. Improved electrodis or instruments for applying the different currents to any part of the human body, both internally and outside.
6. Small electric batteries to carry in coat pocket.
7. New invention of an ozone generator, for inhalation of ozone in tuberculosis or lung diseases.
8. Electric belts and other appliances as worn on the body for the stimulation of nerves or muscles.

The Automatic Electric Alarm Co., 1009 Arch Street, Philadelphia, exhibit an "Automatic Detector" for low water in fire buckets. This device is a new invention calculated chiefly for use in factories, mills, etc., to remind the attendants in the office by ringing electric bells whenever the water in these fire buckets has evaporated down to a certain mark, that the buckets must be filled up again.

The exhibit of Lippincott & Co.'s soda apparatus makes a grand display and adds much not only to the exhibits but to the comfort of guests by way of refreshments.

All of which is most respectfully submitted.

D. H. BRANSON, *Committee.*

CLASS 84.

Sewing silks exhibited by the Branard Armstrong Co., 621 Market street, Philadelphia. The exhibit is large and the display very meritorious. A Report.

CLASS 85.

The exhibit of cotton duck and awning duck and R. A. Humphreys, 1006 Ridge avenue is very good.

The exhibit by Partridge & Richardson, North Eighth street, Philadelphia, of fancy trimmings and fancy goods is very fine and entitled to a diploma.

Ladies' dress goods, an exhibit by Ricketts & Prince, Howard street, Philadelphia, is one of the attractive features in the main building and are recommended a diploma.

For the display of worsted coatings and worsted cloakings by Ricketts & Prince, are awarded a diploma, and to James R. Thompson, 1220 Market street, Philadelphia, for an exhibit of carpets, diploma and a report to Hercules, Atkins & Co., 825 Arch, for a display of carpets.

CLASS 86.

The exhibit of men's clothings by E. O. Thompson, 1338 Chestnut street, Philadelphia, was very good and we award a diploma.

For a fine exhibit of millinery goods a diploma to John Wanamaker. Also a diploma for the finest exhibition of silk embroideries to John Wanamaker. For the fine display of ladies costumes, wraps and furs a diploma to John Wanamaker, and for the exhibit of men's furnishing goods on great variety and fine quality a diploma to John Wanamaker.

Gentlemen of the Agricultural Society: Your committee appointed to judge in Department 5, Group 26, Classes 84 and 85, would report that all exhibits in these classes are very meritorious and are recommended all the awards opposite their respective entries.

D. H. BRANSON,
H. GREEN,
Committee.

LADIES DEPARTMENT.

CLASS 1—FINE ARTS.

Best oil painting.

Miss Amy Rettew, 3921 Locust street, Philadelphia, first premium, . . . $10 00
Frank Linton, 1310 North Fifteenth street, Philadelphia, second premium, . . . 5 00

Landscape in oil.

Miss C. Records, Moore's, Delaware county, Pa., first premium, . . . 4 00
Ellen Malatesta, 742 South Eighth street, Philadelphia, second premium, . . . 2 00

Flowers in oil.

Miss Knapp, 1911 Tioga street, Philadelphia, first prèmium, 4 00
Miss C. Records, Moore's, Delaware county, Pa., second premium, . . . 2 00

Water colors.

Miss Addie Shaw, 2627 Montgomery avenue, Philadelphia, first premium, . . . 10 00
Miss C. Records, Moore's, Delaware county, Pa., second premium, . . . 5 00

STUDIES FROM NATURE.

Oil painting.

Mrs. John Bardsley, 2916 North Sixteenth street, Philadelphia, first premium, . . . 10 00
W. M. Day, 1115 Lehigh avenue, Philadelphia, second premium, . . . 5 00

Original design in oil.

Miss D. L. Hilton, 821 Vermont avenue, Washington, D. C., first premium, . . . 4 00

Water colors—original designs.

Mrs. D. L. Hilton, 821 Vermont avenue Washington, D. C., first premium. $4 00
Miss Amy T. Whelen, Bryn Mawr, Pa., second premium, . 2 00

Painting on Satin.

Miss Clayanna Piper, Chambersburg, Pa., first premium, . 5 00
Miss Amelia Peters, 421 Spencer street, Philadelphia, second premium, ... 3 00

Painting on plush or velvet.

Miss Amy T. Whelen, Bryn Mawr, Pa., first premium, . . 3 00
Miss Addie Shaw, 2627 Montgomery avenue, Philadelphia, second premium 2 00

Kensington painting.

Miss G. E. Kellogg, Mt. Holly, N. J., first premium, ... 1 00
Mrs. John Bardsley, 2916 North Sixteenth street, Philadelphia, second premium, ... 50

Lustra painting.

Mrs. J. E. Phars, Mt. Holly, N. J., first premium, ... 2 00
Mrs. John Bardsley, 2916 North Sixteenth street, Philadelphia, second premium, ... 1 00

Iridescent painting.

Mrs. A. E. Thayer, 1829 Mervine street, Philadelphia, first premium, ... 1 00

Painting on Wood.

Miss Helen L. Gaskill, Birmingham, N, J., first premium, . 5 00
Mrs. G. E. Kellogg, Mt. Holly, N. J., second premium, . . . 3 00

Painting on Brass.

Mrs. G. E. Kellogg, Mt. Holly, N. J., first premium, ... 2 00
Mrs. K. M. Lane, Williamsport, Pa., second premium, . . . 1 00

Crayon Drawing—Copy.

Miss R. C. Braffy, Moore's Station, Delaware county, Pa., first premium, ... 3 00
Anna Cox, Toughkenamon, Chester county, Pa., second premium, ... 2 00

Pencil Drawing, Original Design.

Miss Addie Shaw, 2627 Montgomery avenue, Philadelphia, first premium, ... 3 00

MISCELLANEOUS.

Painted tile.

Mrs. C. Records, Morris, Delaware county, Pennsylvania, first premium, ... $3 00
Mrs. B. C. Walcott, Mount Holly, New Jersey, second premium, ... 2 00

Painting on china or porcelain—thirteen pieces.

Mrs. E. A. Gaskill, 1604 Allegheny avenue, Philadelphia, first premium,	4 00

Painting on china or porcelain.

Miss Louisa Johnson, 3800 Haverford street, Philadelphia, first premium,	2 00
Miss C. Records, Morris, Delaware county, Pennsylvania, second premium,	1 00

Painting on shell.

Miss Ella Malatesta, 742 South Eighth street, Philadelphia, first premium,	2 00

Painting on slate.

Helen L. Gaskill, Birmingham, New Jersey, first premium,	2 00

Painting on pottery.

Mrs. Norman M. Jones, 168 Queen street, Germantown, first premium,	2 00
W. F. Day, 1115 Lehigh avenue, Philadelphia, second premium,	1 00

Bone carving.

Mrs. Stacy T. Haines, Vincentown, New Jersey, first premium,	2 00

Modeling in clay.

Mrs. J. E. Pharo, Mount Holly, first premium,	2 00
Mrs. Dr. Thimme, Reading, Pennsylvania, second premium,	1 00

Repousse work in brass.

Mrs. Theodore Stoy, Merchantville, New Jersey, first premium,	2 00
Miss Amy T. Wheelen, Bryn Mawr, Pennsylvania, second premium,	1 00

Wood carving.

Agda Melin, Sumac street and Freeland avenue, Wissahickon, first premium,	2 00
Miss M. V. Harbert, 4806 Fairmount avenue, Philadelphia, second premium,	1 00

Scroll sawing.

I. T. White, 818 North Twenty-first street, Philadelphia, first premium,	1 50

Hair work.

F. A. Somerndike, 3622 Chestnut street, Philadelphia, first premium,	1 00

Sofa afghan in wool.

Mrs. N. M. Jones, 168 Queen street, Germantown, first premium,	2 00

Zephyr work—greatest variety stitches.

Mrs. M. N. Catshott, 2545 Mascher street, Philadelphia, first premium, ... 2 00

Plain zephyr work.

Mrs. L. M. Broffy, Morris, Delaware county, Pennsylvania, first premium, ... 1 00
G. L. Payne, Roxborough, Philadelphia, second premium, . 50

Tufted zephyr work.

A. E. Folwell, Columbus, New Jersey, first premium, . . . 1 00
Mrs. L. B. Rogers, 2140 North Twentieth street, Philadelphia, second premium, ... 50

Gobelin work.

Mary E. Williams, Merchantsville, New Jersey, first premium, ... 1 00

Foot-rest in wool.

Mrs. M. A. Rorer, 4510 Paul street, Philadelphia, first premium, ... 1 00
Mrs. G. N. Haggard, Chestnut Hill, Philadelphia, second premium, ... 50

Sofa cushion on canvas.

Mary Robbins, 1711 North Ninth street, Philadelphia, first premium, ... 1 00

Pair slippers on canvas.

A. E. Folwell, Columbus, New Jersey, first premium, . . . 1 00

Crocheted slippers in wool.

Miss Lillie V. Richardson, 1618 Green street, Philadelphia, first premium, ... 1 00

Lamp stand mat in zphyr or crewel.

Mrs. S. H. Griscom, Ellisburg, N. J., first premium, ... 1 00

Knitted lace in Saxony wool or split zephyr.

G. L. Payne, Roxborough, Philadelphia, first premium, . . 2 00

Silk patchwork, best quilt.

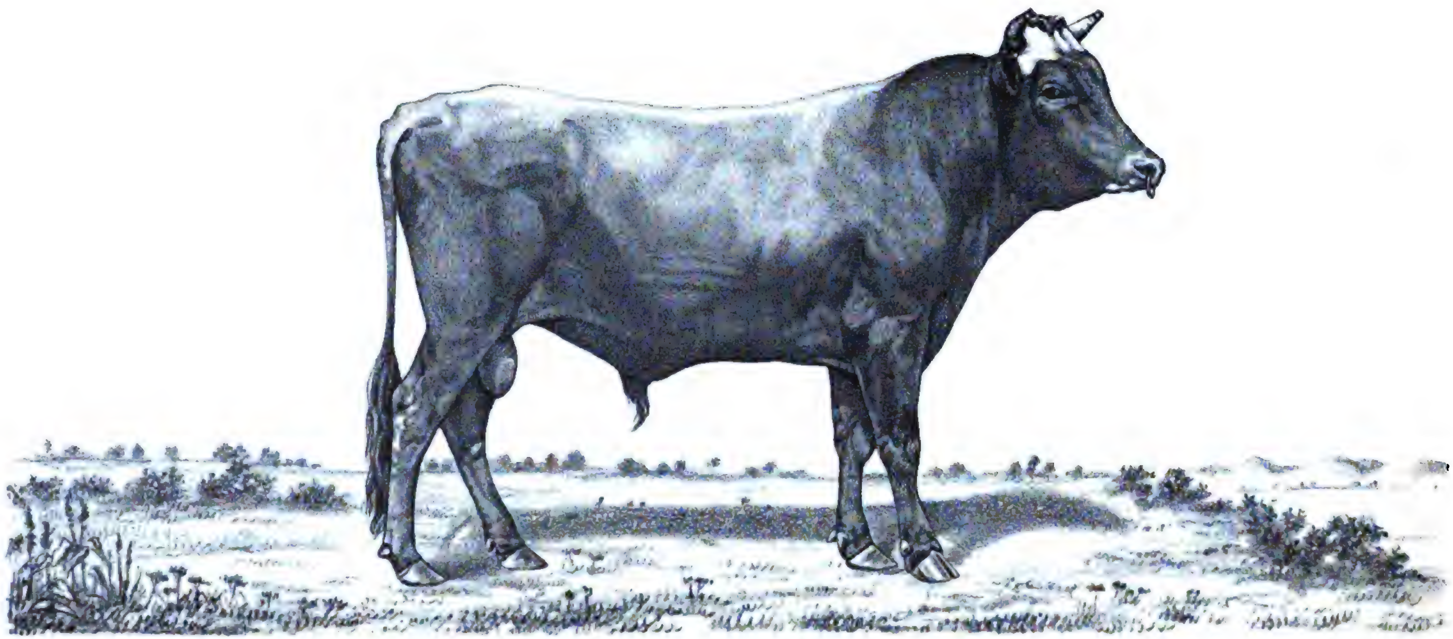
Mrs. R. S. Bodine, Pemberton, New Jersey, first premium, . 2 00
Mrs. Frank Spohn, Ardmore, Pennsylvania, second premium, 1 00

Silk crazy work bed quilt.

Miss Sallie Hevner, 137 North Nineteenth street, Philadelphia, first premium, ... 2 00
Mrs. Sallie C. Boys, 1730 North Fifteenth street, Philadelphia, second premium, ... 1 00

Fancy sofa cover.

Rose S. Thomas, 1538 Tioga street, Philadelphia, first premium, ... 2 00
Mrs. R. S. Bodine, Pemberton, New Jersea, second premium, . 1 00



LORNE POGIS 2ND.

JERSEY BULL.—WINNER FIRST PRIZE PENNSYLVANIA STATE FAIR, 1887. BETWEEN 2 AND 3 YEARS.
ALSO, HEAD OF HERD WINNING SPECIAL PRIZE, OFFERED BY "THE AMERICAN JERSEY CATTLE CLUB," AT EXHIBITION, 1887.
OWNED BY S. KIRKPATRICK, FAIRMOUNT PARK DAIRY, PHILADELPHIA, PA.

Fancy bed cover.

Miss Sophia Scherr. 1825 Allegheny avenue, Philadelphia, first premium, ... $2 00
Mrs. Mary Haefner, 4642 Westminister, West Philadelphia, second premium, ... 1 00

Cotton bed quilt.

Mrs. William H. Royer, 1734 North Seventh street, Philadelphia, first premium, ... 1 00

Crotcheted bed spread.

Miss Minnie E. Williams, Green Bank, Delaware, first premium. 1 00
Miss Nan. Little, Columbia, Pennsylvania, second premium, 50

Fancy pillow shams.

Miss M. C. Broffy, Moore's, Delaware county, Pennsylvania, first premium, ... 2 00
Mrs. H. May, 804 North Seventh street, Philadelphia, second premium, ... 1 00

Rug.

Miss E. B. Brodnax, Bristol, Pennsylvania, first premium, . 2 00
Mrs. Isabella Thompson, 724 Spring Garden street, Philadelphia, second premium, ... 1 00

Portiere.

Mrs. N. M. Jones, 168 Queen street, Germantown, first premium, ... 2 00
Miss Ella Borroll, Elkton, Maryland, second premium, . . . 1 00

Plain needlework, display three articles.

Miss R. S. Brodine, Pemberton, New Jersey, first premium, . 3 00

Plain needlework.

Miss R. S. Brodine, Pemberton, New Jersey, first premium, . 1 00

Fancy apron.

Miss Annie Barry, 2308 Cedar street, Philadelphia, first premium, ... 2 00
A. E. Folwell, Columbus, New Jersey, second prmium, . . 1 00

Button holes.

Miss R. S. Brodine, Pemberton, New Jersey, first premium, . 2 00

Darning.

Miss R. S. Brodine, Pemberton, New Jersey, first premium, . 1 00
Mrs. Lydia Fleming, 1221 Fairmount avenue, Philadelphia, second premium, ... 50

Patching.

Miss R. S. Brodine, first premium, ... 1 00

Fancy darning.

Mrs. E. E. McKnight, 123 East Hanover street, Trenton, New Jersey, first premium, ... 1 00

Three articles cotton embroidery.

Mrs. John Block. Mt. Holly, New Jersey, first premium, . .	$2 00
Mrs. S. H. Griscom, Ellisburg, New Jersey, second premium,	1 00

CLASS 4.

Cotton embroidery.

Mrs. Thomas Taylor, Mt. Holly, New Jersey, first premium,	1 00

Venetian or button hole embroidery.

Mrs. R. S. Price, Pemberton, New Jersey, first premium, . .	1 00

Embroidery on linen momie cloth.

Miss M. E. Williams, Merchantsville, New Jersey, first premium, ...	1 00

Pair towels, satin stitch embroidery.

Mrs. John Black, Mt. Holly, New Jersey, first premium, . .	1 00

Pair towels, cross stitch.

Mrs. Rebecca Price, Pemberton, New Jersey, first premium,	1 00
Mrs. R. S. Bodine, second premium, ...	50

Pair towels, outline embroidery.

Mrs. R. S. Bodine, first premium, ...	2 00
Miss Ella Malatesta, 742 South Eighth Street, Philadelphia, second premium, ...	1 00

Braided work.

Mrs. R. S. Bodine, first premium, ...	2 00

Applique work..

Mrs. L. B. Rogers, 2140 North Twentieth Street, Philadelphia, first premium, ...	2 00

Drawn thread work.

Lidie P. Jones, 702 Swede Street, Norristown, Pennsylvania, first premium, ...	2 00
Mrs. Jos. J. Hays, 1224 North Twenty-Seventh Street, Philadelphia, second premium, ...	1 00

Bead work.

Mrs. N. Green, 2004 Norris Street, Philadelphia, first premium, ...	1 00
Miss R. S. Bodine, second premium, ...	50

CLASS 5.

Display crocheted work, greatest variety.

Mrs. Lina Fleming, 1291 Fairmount Avenue, Philadelphia, first premium, ...	3 00
Mrs. Jos. W. Bromwell, 1921 Fountain Street, Philadelphia, second premium, ...	2 00

Crocheted cape.

Miss E. M. Hilton, Moorestown, New Jersey, first premium,	$1 00
Mrs. L. B. Rogers, 2140 North Twentieth Street, Philadelphia, second premium,	50

Crocheted shawl.

Miss Clara E. Rowlett, 607 North Sixteenth Street, Philadelphia, first premium,	1 00
Ida Johnson, Chestnut Hill, second premium,	50

Crocheted skirt.

Miss Mattie J. Scott, Wayne and Schoolhaven Streets, Germantown, first premium,	1 00
Nellie Lamborne, 1017 Vine Street, Philadelphia, second premium,	50

Crochet work in ice wool.

Miss E. M. Hilton, Moorestown, New Jersey, first premium,	1 00
Ella Maletesta, 472 South Eighth Street, Philadelphia, second premium,	50

Crocheted nubia or fascinator.

Miss Mary E. Williams, Merchantsville, New Jersey, first premium,	1 00
Mrs. S. H. Griscom, Ellisburg, New Jersey, second premium,	50

Crocheted hood.

Mrs. L. B. Rogers, 2140 North Twentieth Street, Philadelphia, first premium,	1 00
Miss K. M. Lane, Williamsport, Pennsylvania, second premium,	50

Pair crocheted mittens.

Miss Clayanna Piper, Chambersburg, Pennsylvania, first premium,	50

Crocheted purse.

Miss Mary E. Williams, first premium,	1 00
Mrs. H. Curnow, 1539 North Twenty-Seventh Street, Philadelphia, second premium,	50

Crocheted articles for infants' wear.

Mrs. J. R. Snyder, 1331 Tasker Street, Philadelphia, first premium,	2 00

Irish Jesuit lace.

Mrs. Stacy F. Haines, Vincentown, New Jersey, first premium,	1 00

Crocheted lace or edging, one-eighth yard.

Mrs. Thomas Taylor, Mt. Holly, New Jersey, first premium,	2 00

Crocheted work with fancy braid, one-eighth yard.

Miss Ellen Barroll, Elkton, Maryland, first premium, . . . $2 00

Pair fancy knitted cotton stockings

Mrs. Lina Fleming, 1291 Fairmount Avenue, Philadelphia, first premium, ... 1 00

Mary Ann Scherr, 1825 Allegheny Avenue, Philadelphia, second premium, ... 50

Pair plain knitted cotton stockings.

Mrs. Lydia Fleming, 1221 Fairmount Avenue, first premium, . 1 00

Pair knitted silk socks.

Mrs. Fannie W. Kughler, East Orange, New Jersey, first premium, ... 1 00

Woolen knitted socks.

Ida Johnson, Chestnut Hill, first premium, ... 1 00

Pair knitted silk mittens.

Miss Ellen Barroll, Elkton, Maryland, first premium, . . . 1 00

Pair knitted wool mittens.

Mrs. L. B. Rogers, 2140 North Twentieth Street, Philadelphia, first premium, ... 50

Miss Ellen Barroll, second premium, ... 25

Ladies' knitted skirt.

Mrs. L. B. Rogers, first premium, ... 2 00

Display knitted lace edging, one-eighth yard.

Mrs. Thomas Taylor, Mt. Holly, New Jersey, first premium, 2 00

Netting.

Mary Anna Scherr, 1825 Allegheny avenue, Philadelphia, first premium, ... $1 00

Rick-rack work.

Mrs. J. M. Sickler, Salem, New Jersey, first premium, . . . 1 00

Miss Minnie Kelley, 1434 Park avenue, Philadelphia, second premium, ... 50

Crocheted insertion.

Irene E. Lloyd, 504 North Forty-first street, Philadelphia, first premium, ... 2 00

Fancy knitted silk stockings.

Miss Clayanna Piper, Chambersburg, Pennsylvania, first premium, ... 1 00

CLASS 6—SILK EMBROIDERED SOFA PILLOW.

Display silk embroidery—three pieces.

Mrs. A. H. Dwinel, 38 North Thirty-sixth street, Philadelphia, first premium, ... $3 00

Mrs. Thomas Taylor, Mt. Holly, New Jersey, second premium, 2 00

Silk embroidered article on satin.

Mrs. William N. Bruner, 2028 North Fourteenth street, Philadelphia, first premium, ... $2 00
Miss Nellie Wilson, 2302 East York street, Philadelphia, second premium, ... 1 00

Silk embroidery on linen.

Miss H. French, 206 North Thirty-fifth street, Philadelphia, first premium, ... 2 00
Miss Bessie Dunn, 725 Pine street, Philadelphia, second premium, ... 1 00

Silk embrodiery on flannel.

Mrs. John Black, Mt. Holly, New Jersey, first premium, . . 3 00
Mrs. E. D. Heydrick, Chestnut Hill, Pennsylvania, second premium, ... 2 00

Silk embrodiery on cashmere.

Mrs. A. H. Dwinel, 38 North Thirty-sixth street, Philadelphia, first premium, ... 1 00

Silk embroidered table cover.

Mrs. H. M. Day, 1115 Lehigh avenue, Philadelphia, first premium, ... 2 00
Mary A. Makin, Moorestown, New Jersey, second premium, 1 00

Silk embroidered stand cover.

Miss E. M. Hilton, Moorestown, New Jersey, first premium, . 2 00
Miss Einwechter, 1522 North Eighth street, Philadelphia, second premium, ... 1 00

Raised embroidered filoselle.

Mrs. Dr. Thimme, 1246 North Tenth street, Philadelphia, first premium, ... 2 00
Mrs. Dwinel, 38 North Thirty-sixth street, Philadelphia, second premium, ... 1 00

Embroidered piano scarf.

Mrs. H. M. Day, first premium, ... 2 00
Miss Einwechter, 1522 North Eighth street, Philadelphia, second premium, ... 1 00

Fancy table scarf.

Miss B. C. Walcott, Mt. Holly, New Jersey, first premium, . 2 00
Miss N. Roth, Hoyt, Pennsylvania, second premium, . . . 1 00

Fancy table cover.

Mrs. E. A. Heintz, 1000 South Forty-ninth street, Philadelphia, first premium, ... 2 00
Mrs. J. Emar Bierck, 1533 Columbia avenue, Philadelphia, second premium, ... 1 00

Mantle lambrequin.

Annie Barry, 2308 Cedar street, Philadelphia, first premium, 2 00
Miss N. Roth, Hoyt, Pennsylvania, second premium, . . . 1 00

Bracket lambrequin.

Mrs. S. H. Griscom, Ellisburg, New Jersey, first premium, . $1 00
Mrs. Dwinel, 38 North Thirty-sixth street, Philadelphia, second premium, ... 50

Stand cover embroidered in worsted.

Mrs. M. E. Williams, Merchantsville, New Jersey, first premium, ... 2 00

Display of crewel embroidery—three pieces.

Mrs. M. E. Williams, first premium, ... 3 00

Article crewel embroidery.

Mrs. William Kirkbride, Pemberton, New Jersey, first premium, ... 2 00
S. Widmayer, 1714 Warwick street, Philadelphia, second premium, ... 1 00

Ribbon embroidery.

Mrs. Dwinel, first premium, ... 2 00
Miss E. M. Hilton, Moorestown, New Jersey, second premium, 1 00

Embroidery on velvet.

Mrs. C. W. Brodnax, Bristol, Pennsylvania, first premium, . 2 00

Embroidery on plush.

Mrs. M. N. Brunner, 2028 North Seventeenth street, Philadelphia, first premium, ... 2 00

Embroidery with gold thread.

Mrs. E. E. McKnight, Trenton, New Jersey, first premium, . 2 00

Oriental embroidery.

Mrs. H. M., Day, 1115 Lehigh avenue, Philadelphia, first premium, ... 2 00
Mrs. E. E. McKnight, 123 Hanover street, Trenton, New Jersey, second premium. 1 00

Tinsel embroidery.

Mrs. E. E. McKnight, Trenton, New Jersey, first premium, . 2 00
Mrs. S. Brown, 632 North Thirty-ninth Philadelphia, second premium, ... 1 00

Applique embroidery.

Mrs. S. B. Wireback, Montgomery avenue, Philadelphia, first premium, ... 2 00
Mrs. E. E. McKnight, Trenton, New Jersey, second premium, 1 00

Display arasene embroidery—three pieces.

Miss B. C. Wolcott, Mount Holly, New Jersey, first premium, 2 00
John H. Hulse, Tacony, Pennsylvania, second premium, . . 1 00

Article arasene embroidery.

Annie Barry, 2308 Cedar street, Philadelphia, first premium, 2 00
John H. Hulse, Tacony, Pennsylvania, second premium, . . 1 00

Chenille embroidery.

Mrs. M. E. Williams, Merchantsville, New Jersey, first premium, ... $2 00
Miss F. Longbare, 3818 Haverford avenue, Philadelphia, second premium, ... 1 00

Fancy chenille work.

Miss B. C. Wolcott, Mount Holly, New Jersey, first premium, 2 00
Mrs. A. E. Thayer, 1829 Mervine street, Philadelphia, second premium, ... 1 00

Machine work.

Wheeler & Wilson, 1312 Chestnut street, Philadelphia, . . 15 00

CLASS 7.

Lace work—any design.

Mrs. Josie I. Hayes, 1224 North Seventh street, Philadelphia, first premium, ... Diploma.
Mrs. M. L., Martin, 1224 North Seventh street, Philadelphia, second premium, ... 1 00

Bretonne lace darned net.

Mrs. Kate C. McElroy, 217 South Eleventh street, Philadelphia, first premium, ... 2 00
Mrs. H. Curnow, 1539 North Twenty-seventh street, Philadelphia, second premium, ... 1 00

Display outline embroidery, in silk—three pieces.

Mrs. R. S. Price, Pemberton, New Jersey, first premium, . 3 00

Display outline embroidery, in cotton or linen—three pieces.

G. L. Payne, Roxborough, Philadelphia, first premium, . . 3 00
Mrs. R. S. Price, second premium, ... 2 00

Sideboard cloth.

J. E. Lloyd, 504 South Forty-first street, Philadelphia, first premium, ... 2 00
Mrs. H. Curnow, 1539 North Twenty-seventh street, Philadelphia, second premium, ... 1 00

Waiter towel.

Miss G. L. Payne, Roxborough, Philadelphia, first premium, 1 50
Mrs. John Black, Mount Holly, New Jersey, second premium, 75

Bureau scarf.

Mrs. S. B. Wireback, 1737 Montgomery avenue, Philadelphia, first premium, ... 2 00
Mrs. A. E. Thayer, 1829 Mervine street, Philadelphia, second premium, ... 1 00

Banner.

Annie Leonhardt, 116 West Cumberland street, Philadelphia, first premium, ... 2 00

Miss Amy T. Whelen, Bryn Mawr, Pennsylvania, second premium, ... $1 00

Screen.

Mrs. N. M. Jones, 168 Queen street, Germantown, first premium, ... 2 00

Embroidered lamp mat.

A. E. Folwell, Columbus, New Jersey, first premium, . . . 1 00

Table mats.

Mrs. John Black, Mount Holly, New Jersey, first premium, 1 00
Mrs. R. S. Price, Pemberton, New Jersey, second premium, 50

Pair vase mats.

Mrs. S. H. Griscom, Ellisburg, New Jersey, first premium, . 1 00

Work bag or reticule.

Mrs. Dr. Thimme, 1246 North Tenth street, Philadelphia, first premium, ... 1 50

Fancy mirror frame.

Mrs. E. A. Hintz, 1000 South Forty-ninth street, Philadelphia, first premium, ... 1 00

Scrap basket or catch-all.

Mrs. E. E. McKnight, Trenton, New Jersey, first premium, . 1 00

Brush holder.

A. E. Folwell, Columbus, New Jersey, first premium, . . . 1 00

Shoe pocket.

Miss G. L. Payne, Roxborough, Philadelphia, first premium, 1 00

Tea pot holder.

Miss G. L. Payne, Roxborough, Philadelphia, first premium, 75

Dust holder.

Mrs. E. E. McKnight, ... 1 00

Fancy D'Oylies in silk.

Mrs. Jno. Black, Mt. Holly, New Jersey, first premium, . . 1 00
Mrs. C. Funk, 3573 Sansom street, West Philadelphia, second premium, ... 50

Fancy D'Oylies in cotton.

Mrs. S. L. Thompson, 121 North Twentieth street, Philadelphia, first premium, ... 1 00
Mrs. R. Price, Pemberton, New Jersey, second premium, . . 50

Tidy, crocheted.

Mrs. Thos. Taylor, Mt. Holly, New Jersey, first premium, . . $1 00
Mrs. J. E. Pharo, Mt. Holly, New Jersey, second premium, . 50

Embroidered tidy.

Mrs. J. R. Snyder, 1331 Tasker street, Philadelphia, first premium, ... 1 00
Mrs. R. S. Price, Pemberton, New Jersey, second premium, 50

Tidy on Congress canvas.

Mrs. E. A. Hintz, 1000 South Forty-ninth street, Philadelphia, first premium, ... 1 00

Chair scarf.

Mrs. E. E. McKnight, Trenton, New Jersey, first premium, . 1 00

Fancy window curtains.

Mrs. N. M. Jones, 168 Queen street, Germantown, first premium, ... 2 00

CLASS VIII.

Toilet set.

Lizzie F. Murray, Lower Merion, Pennsylvania, first premium, ... 1 00

Painting in oil.

Florence G. McIntyre, 1811 North street, Philadelphia, first premium, ... 2 00
Miss Frances C. Boileau, 1813 Wallace street, Philadelphia, second premium, ... 2 00

Silk embroidery.

J. May Lippencott, 1112 Vine street, Philadelphia, first premlum, ... 1 00

Fancy pin cushion.

Edna L. Parks, 226 North Eighth street, Philadelphia, first premium, ... 1 00

Crocheted lace in Saxony wool.

Mary R. Martin, 1613 Bainbridge street, Philadelphia, first premium, ... 1 00

Silk crazy work.

Miss Taylor, Mt. Holly, New Jersey, (send with Mrs. Thos. Taylor's, Mt. Holly,) first premium, ... 2 00
Ralph W. C. Leach, 2219 Green street, Philadelphia, second premium, ... 1 00

Pen wiper.

Emily Bruner, 812 North Broad street, Philadelphia, first premium, ... 50

Crayon drawing.

Leah Blitz, 1520 Mole street Philadelphia, ... Diploma

Zephyr work.

Miss Estella Coulston, 1008 Lehigh avenue, Philadelphia, first premium, ... $1 00
Jennie Powell, 258 Herr street, Harrisburg, second premium, 50

Penmanship.

Lida B. Dudley, Moorestown, New Jersey, first premium, . 1 00

Needle case.

Miss I. B. Gaskill, Birmingham, New Jersey, first premium, 75

Pencil drawing.

Taylor W. Harper, Christiana, Pennsylvania, first premium, 1 00

Plain sewing, by hand.

Mary R. Martin, 1613 Bainbridge street, Philadelphia, first premium, ... 2 00

Home made bread.

Mrs. C. M. Siddall, 1706 Venango street, Philadelphia, first premium, ... 5 00
Alice I. Siddall, 1706 Venango street, Philadelphia, second premium, ... 3 00

CLASS 87.

John Hartman, 412 South Delaware avenue, Philadelphia, Blue Point crackers, ... Diploma.
Melluard, Cliff & Co., 1532 Stiles street, Philadelphia, crackers, ... Report.
Newton Vogel & Co., 306 Market street, Philadelphia, refined rice starch, ... Diploma.
R. N. Plummer, 1821 North Sixteenth street, Philadelphia, starch polish, ... Diploma.

CLASS 88.

A. J. Chauveau, 110 South Eleventh street, Philadelphia, confectionery, ... Diploma.
George Heppe, 1814 Frankfort avenue, Philadelphia, for largest and most complete exhibit and manufacturing of confections, ... Diploma.

CLASS 89.

Frick Bros., 811 Lehigh avenue, Philadelphia, best collection saddles, ... Diploma.
Frick Bros., best collection harness, ... Diploma.
Frick Bros., best collection horse collars, ... Diploma.
Frick Bros., best collection whips, ... Diploma.
John Wanamaker, trunks and valises, ... Diploma.
W. F. Bainbridge, Eighth and Spring Garden streets, Philadelphia, boots and shoes, ... Diploma.

Your committee, after a careful examination, have awarded the diplomas and reports as made opposite the respective exhibits.

W. B. TILL,
B. P. THOMPSON,
JAS. R. PIPER,
Committee.

CLASS 91.

M. L. Shoemaker Company, Venango and Delaware avenues, Philadelphia, lard, oils and stearine, . . A diploma for each exhibit.

CLASS 92.

Keystone Chemical Company, 223 South Front street, Philadelphia, condensed soap, ... Diploma.
William Dreydopple, 208 North Front street, Philadelphia, large display soaps, ... Diploma.
W. T. Marks, 320 North Second street, Philadelphia, soap polish, ... Diploma.
Arthur Frick, 218 Arch street, Philadelphia, perfumery, . . Diploma.
McCambridge & Son, 81 South Sixth street, Philadelphia, floral extracts and cologne, ... Diploma.
P. C. Tomson & Co., 248 North Third street, Philadelphia, soap powders, ... Report.
Walter Sellers, 569 Cannon street, Camden, New Jersey, Pyle's peerless soap powders, ... Diploma.

The above report is respectfully submitted by the committee.

W. B. TILL,
B. P. THOMPSON,
Committee.

CLASS 93—PAINTS AND COLORS.

Nice & Raw, 328 South Second street, Philadelphia, varnishes, ... Diploma.
Nice & Raw, Excelsior liquid, ... Diploma.
Nice & Raw, paints, ... Diploma.
W. R. Warner & Co., 1228 Market street, Philadelphia, . . Diploma.

CLASS 94—DRUGS.

Alex. Kerr Bros. & Co., Piers 8 and 8½, Philadelphia, salt., . Diploma.
G. W. & W. H. Bumm, Delaware avenue and Race street, Philadelphia, Higgins Eureka salt, ... Diploma.
W. R. Warner & Co., 1228 Market street, Philadelphia, pharmaceutical preparations, ... Diploma.
Vail Boas, 239 Market street, Philadelphia, Ideal tooth powder, ... Silver medal.
Henry Tetlow, Tenth and Cherry streets, Philadelphia, Tetlow's face powder, ... Diploma.
P. C. Tomson, 248 North Third street, Philadelphia, granu lated lye, ... Diploma.
Weikel Smith Spice Company, 133 North Front street, Philadelphia, pure spices, ... Diploma.
Weikel Smith Spice Company, Lemberger oil paste polish, . Diploma.

The exhibits of salt are superior to any heretofore made at the fairs of this Society. Though Kerr Bros. & Co. make the largest, and, according to your committee's judgment, the best exhibit, we heartily commend that of G. W. & W. H. Bumm, and particularly their Higgins English salt, especially adapted to household and dairy purposes.

The above awards of your committee are respectfully submitted.

W. B. TILL,
B. P. THOMPSON,
Committee.

CLASS 95.

John Wanamaker, dining room furniture, ... Diploma.
Philadelphia Folding Bed and Desk Company, 919 Arch street, Philadelphia, roll top desk, ... Diploma.

CLASS 96.

Ridgway Manufacturing Company, 815 Arch street, Philadelphia, refrigerators, ... Diploma.
Philadelphia Folding Bed and Desk Company, 919 Arch street, Philadelphia, folding beds, ... Diploma.
John Wanamaker, upholstery, ... Diploma.

CLASS 97.

John Wanamaker, table cutlery, ... Diploma.

CLASS 98.

John Wanamaker, Haverland's fine French china, ... Diploma.

CLASS 99.

Wheeler & Wilson, 1312 Chestnut street, Philadelphia, double thread sewing machines, ... Diploma.
Wheeler & Wilson, button-hole machine, ... Diploma.
Julius Resture, 1732 South Thirteenth street, Philadelphia, washing machine and motor, ... Report.
C. Mears & Son, Bloomsburg, Pennsylvania, washing machine, ... Report.
Conson Bros. & Co., Philadelphia, ironing table, ... Report.
James Bing, Philadelphia, mangle, ... Diploma.
John Wilde, Chester, Pennsylvania, mangle, ... Report.
Bullock Manufacturing Company, 1361 Ridge avenue, Philadelphia, Hortman's meat and vegetable chopper, ... Report.
Israel L. Landis, Lancaster, Pennsylvania, meat and vegetable slicer, ... Diploma.
John Wanamaker, fine display clocks, ... Diploma.

Your committee respectfully submit the foregoing as their report in Classes 95, 96 and 99. They would state that in the competition of washing machines and mangles the exhibits were excellent and the decisions difficult to arrive at. The display of Wheeler & Wilson and American sewing machines were particularly fine, especially that of the former, which were worthy great praise.

W. B. TILL.
JAS. R. PIPER.
B. P. THOMPSON.

CLASS 100.

James Lanning, 822 Eneu street, Philadelphia, patent heater grates, ... Diploma
Samuel Huet, 251 South Second street, Philadelphia, wood mantles, ... Diploma.
Liebrandt & McDowell Stove Company, 123 North Second street, Philadelphia, parlor stoves, ... Diploma.
W. S. M. Lieber, 638 Arch street, Philadelphia, gas heating office and parlor stoves, ... Diploma.

W. S. M. Lieber, oil heating office and parlor stoves, . . . Diploma.
Job Bartlett's Sons, Tenth and Filbert streets, Philadelphia, portable furnace, ... Diploma.
Job Bartlett's Sons, permanent heater, ... Diploma.

CLASS 101.

Liebrandt & McDowell Stove Company, Philadelphia, cook stoves, ... Report.
W. S. & M. Lieber, 638 Arch street, Philadelphia, gas cooking stoves, ... Report.
W. S. & M. Lieber, petroleum cooking stoves, ... Report.
Conrow Bros. & Co., 903 Market street, Philadelphia, tinware for culinary purposes, ... Diploma.
Conrow Bros. & Co., cooking hardware, ... Diploma.
H. Nutrizo, 638 Arch street, Philadelphia, Nutrizo coffee pot, ... Report.
Union Indurated Fibre Company, 110 Chambers street, New York, a splendid exhibit of useful articles, ... Diploma.

CLASS 103.

A. J. Weidner, 36 South Second street, Philadelphia, an excellent exhibit of lamps of all kinds, ... Diploma.
Penn Globe Gas Light Company, Philadelphia, a large and interesting exhibit of gas apparatus and lamps for cities and lawns, ... Report.
Alexander Morrison, 118 South Seventh street, Philadelphia, lamps and burners, and royal Argand gas burners, . . . Report.

Your committee beg leave to make this as their peport.

W. B. TILL,
F. P. HAEHNLEN.

CLASS 104.

Borgner O'Brien, Twenty-third above Race, Philadelphia. Fire bricks and dry retorts. Cannot be surpassed, and of highest character.

Edward Sutton, 300 Market street, Philadelphia. Automatic and farm gates. Are simple in construction, and perfect in action, and the Burton steel star twisted post, exhibited by the same firm, are good posts.

Marvin Safe Company, 723 Chestnut street, Philadelphia. Fire and burglar proof safes. Are No. 1; no need of commendation, their reputation is established. They have new combinations of unusual excellence.

David Pettitt & Co., 1219 Callowhill street, Philadelphia. Iron fence for gardens. Is of the best material and character.

George W. Zeigler, Washington, D. C. Scaffolding and tresseling. Is simple, and makes a strong scaffold and highly recommended.

John A. Grove, Bluffton, Indiana. Straight rail fence, portable fence, post and rail fence. Very ingenious and worthy of more than ordinary mention.

James M. Vance & Co., Philadelphia. Builders' hardware. A very fine exhibit of hardware and door locks, which are of the finest.

McEwen Lawrence, 11 South Seventh street, Philadelphia. Terra cotta fence posts. Good of the kind.

CLASS 105.

Trinidad Asphalt Company, Philadelphia. Asphalt paving blocks. Variety and good material recommended.

Whillden Pottery Company, 713 Wharton street, Philadelphia. Earthen flower pots. A fine display and of good quality.

Manly & Cooper Manufacturing Company, 4150 Elm avenue, Philadelphia. Iron fence, gates, &c. A very fine exhibit, embracing a great variety.

Edward Sutton, Philadelphia. Iron sofas and chairs, and woven wire fencing. This display is highly recommended, elaborate, and deserves especial mention.

C. W. & H. W. Meddleton, 943 Ridge avenue. Wire fencing is highly recommended.

Hartman Steel Company, 434 Commerce street, Philadelphia. Wire fencing. This steel fencing is highly recommended, and is one of superior excellence.

CLASS 106.

A. M. Peterson, 140 South Fourth street, Philadelphia. Water filter. This filter was in operation in Floral hall. A practical test being made, showing it of superior excellence and doing its work well. We recommend it to the public.

W. Heaton, 503 Chestnut street, Philadelphia. Cotton, linen hose. Are highly recemmended.

B. F. HART,
B. S. KUNKLE,
Committee.

CLASS 108.

Ripka & Company, 140 South Eighth street, Philadelphia, best collection drawing implements and artists' materials, Diploma.

Charles W. Frost, 104 South Thirty-eighth street, Philadelphia, building blocks, an excellent collection, giving stability to structures formed, ... Diploma.

F. H. Drake, 7 South Tenth street, Philadelphia, stylographs and fountain pens of superiority of design and workmanship, ... Diploma.

Ripka & Company, wax flowers worthy of mention for beauty of execution.

Charles E. Osborn, 1421 Fairmount avenue, Philadelphia, display of shells, minerals, etc., ... Diploma.

John Wanamaker, Philadelphia, school supplies, ... Diploma.

CLASS 109.

M. Zineman & Brother, 130 South Ninth street, Philadelphia optical goods, for excellence of glasses, material and grinding and polishing, ... Diploma.

CLASS 110.

CARVED AND MOULDED.

Georgia Marble Distributing Company, 1029 Chestnut street, Philadelphia, monuments and coping in marble, a variety of veined and solid tints, sawed and polished, ... Diploma.

W. C. Randolph, 243 Arch street, Philadelphia, an exhibit of ivory turning and ivory goods, ... Diploma.
J. A. Brown, 1351 Chestnut street, Philadelphia, for display of Japanese and Chinese goods, ... Honorable Mention.

CLASS 111.

ON PAPER AND CANVAS.

P. E. Chillman, 912 Arch street, Philadelphia, photographs remarkable for delicacy, distinctness of outlines and beauty of finish, ... Diploma.
P. E. Chillman, drawings in crayon, ... Diploma.
Van Dyke & Company, 109 North Seventh street, Philadelphia, for great variety of lithographs. . . . . Honorable Mention.

A. L. KENNEDY,
Committee.

CLASS 113.

IMPLEMENTS OF OUT-DOOR SPORT.

The display of bicycles, tricycles and velocipedes, by the well-known firm, Hart Cycle Company, 811 Arch street, Philadelphia, is of the finest character, and the attraction of the exhibit is shown by the number of visitors to be seen around the same at all hours. The adjustable and extensible arrangements invented by Mr. Hart deserves especial mention.

W. H. Abbott, 618 Market street, Philadelphia, guns and fishing tackle, is of that character that reflects credit and deserves the highest commendation.

George W. Ziegler, Washington, D. C., lawn swing, easily adjusted and simple in construction.

R. A. Humphry's, 1006 Ridge avenue, Philadelphia, tents, stools and camping outfit;, extensive and reflects credit as a manufacturer.

R. A. BENTLY,
B. C. BARKER,
Committee.

CLASS 114.

UNCLASSIFIED.

Weekel & Smith Spice Company, 133 North Front street, the automatic package making and filling machine does the work of eight expert packers.

Walker, Sons & Company, 16 South Fourth street, steel stamps, baggage and hotel checks, surety seals, etc., are all admirably suited to their respective uses.

S. M. Quest & Son, 14 South Fourth street, rubber stamps, stamp supplies, stencils, inks, brushes and presses in great variety.

Cartright Metal Roofing Company, Philadelphia, the roofing is entirely new in design and pattern, is easily put on, perfectly tight against dust, rain, snow or drifts, does not corrode at joints and it commends itself to the public.

Estate of W. Obdyke, 1609 Pine street, model tin house showing specimen of roofing by using tin.

Philadelphia Ornamental Wire Company, household wire goods, great skill in design, and all are of practical use and great convenience.

J. Wilson Heald, Fifteenth and Fairmount avenue, anti-shaft rattler and shaft support is a most admirable arrangement and will soon be generally used.

Mexican Agate-Onyx Company, 263 South Sixth street, Philadelphia. This exhibit of Mexican agate-onyx is one of the best in the main building. The agate-onyx admits of a very high polish, and it comes in variegated colors, as shown in the stands, tables, furniture, mantels, hearth fuel, &c.

Pratt Food Company, 126 South Second street, Philadelphia. Pratt's food for horses, cattle and poultry has been tried and proven valuable, being free from mineral poisons. It is always a safe food.

Michner Brothers & Company, 130 North Second street, Philadelphia, exhibit royal poultry food, and, without doubt, it is a most excellent food for poultry.

Capt. Natt. Atkinson, Ashvill, North Carolina, exhibits giant growth of cereals, also of grasses in great variety and enormous length, and all speak well of the productiveness of the soil in which they are grown and reflect credit on the growers or farmers. The exhibit is worthy honorable mention.

George B. Rowlett, 1011 Market street, Philadelphia, anti-sash rattler, has many merits to commend it to the public, as it leaves the sash free to raise as well as to lower.

John J. Smith, 821 Spring Garden street, Philadelphia, blind and window sash; a convenient article.

George H. Richards, Twenty-second and Spring Garden street, Philadelphia, patent window sash; a good article.

W. G. Snyder, Reading, Pennsylvania, window frame and sash; an improvement in sashes.

Walker Sons & Company, 16 South Fourth street, Philadelphia, hand stamps and appliances. A large display of hand stamps, rubber stamps, stencils, marking plates, &c.

J. M. Murray & Company, 9 North Thirteenth street, Philadelphia, exhibit Ceylon tea and coffee, and give a fair, honest trial of their beverages. We cheerfully commend them as unadulterated articles. Their tea is especially fine. We recommend a diploma.

J. J. Bissell & Company, 20 South Broad street, Philadelphia, clothes-line elevator; a very convenient and useful article.

M. L. Shoemaker & Company, Venango and Delaware avenues, fertilizers. A fine display of the best fertilizers, too numerous to mention.

Kughler & Co., 26 North Sixth street, Philadelphia, indestructible fuel cartridges, are all they claim. They are a substitute for coal or wood, for heating purposes, at only one-third their cost. They can be safely used in any stove. We recommend a diploma.

James Gardiner, Mantua, N. J., patent hog-scalder, merits the endorsement of the Society.

W. L. Porter, Twenty-third and Columbia avenue, Philadelphia, patent ash-sifter, will be generally used as soon as introduced. It not only does the sifting well, but confines the dust in the vessel, so that sifting coal or ashes can be done without having the air filled with dust.

Edison Fire Extinguisher Company, 529 Arch street, Philadelphia. This fire extinguisher was publicly tested, and is not only well-named, but is true to its work. Every family should have one. We recommend a diploma.

Lantz Bros., 614 Arch street, Philadelphia, tack-lifter and holder combined, is a very convenient, cheap article.

A. G. Elliott, 30 South Sixth street, Philadelphia, parchment paper, is made of finest linen and cotton fibre, and is air-proof, water-proof, and oil-proof; is tasteless and odorless, and prevents evaporation and shrinkage, and is indestructible in hot or cold water, or brine; and, when wet, is flexible as vellum; can be washed like muslin, and possesses great strength, and is purer, cheaper, and cleaner than cloth for dairy, creamery, and many other purposes. We recommend a diploma.

A. L. Butz, 212 Market street, Philadelphia, cork and cork-cutting machine, an interesting exhibit.

Auburn Mineral Water Company, 910 Race street, Philadelphia, Auburn spring water, an excellent water for family use, especially for invalids.

A. J. Williams, Marshallton, Delaware, metal polish, was severely tested, and its great value proven in every case. With little labor, rusted and tarnished cutlery, tinware, &c., were made new again. Diploma.

S. E. Clark, 734 Market street, Philadelphia, harmless gun, is a neatly finished toy gun that fires hollow rubber balls. There is no danger in its use.

George A. Moore, 668 North Broad street, Philadelphia, carriage gearing springs, an improvement in carriage springs.

H. N. Black, 1238 Ridge avenue, Philadelphia, lever bar springs, are a great improvement over the old springs, and no doubt will soon come into use by carriage builders.

G. F. Ford, Roxbury, Philadelphia, patent milk strainers, a real improvement in strainers. It can be easily taken apart, kept clean much easier than the old style, and it is just the strainer to use in making jellies and in general household use. It is made up in a variety of shapes and sizes, suitable for different uses. Diploma.

Lane Brothers, Poughkeepsie, New Jersey, patent door hangers, is a practical and useful article, and is strong and durable.

Allen G. Moyer, Danboro', Pennsylvania, patent butter shipping cases, are a convenient article for shipping butter.

R. A. Humphreys, 1006 Girard avenue, tool bags, very strong, durable and convenient, and well adapted for its use.

JNO. McDOWELL,
JAS. R. PIPER,
Committee.

REPORT

OF THE

State Horticultural Association of Pennsylvania.

CONSTITUTION.

ARTICLE 1. This Society shall be entitled the "Pennsylvania Fruit Growers' Society,"* and its object shall be the advancement of the science of pomology, and the art of fruit culture generally.

ARTICLE 2. Any person may become a member of this Society by a vote of a majority of the members present, at any meeting, and by paying into the treasury the sum of one dollar annually; or the payment of one dollar to the treasurer, at any time, shall constitute membership, and entitle said member to a copy of the proceedings. The payment of ten dollars, at one time, will constitute life membership.

ARTICLE 3. Its officers shall consist of a President, three Vice Presidents, a Recording and Corresponding Secretary and a Treasurer, all of whom shall be elected annually by ballot.

ARTICLE 4. The following standing committees shall be appointed: A Committee of five on Nomenclature; a Committee of three on Insects, of whom the professor of entomology shall be chairman; an Executive Committee, consisting of the President, Recording Secretary and Treasurer; † and a General Fruit Committee, consisting of one member from each county represented, with a general chairman of the whole; each member of the Local Fruit Committee to have the privilege of appointing two assistants.

ARTICLE 5. The Society may, at any time, elect honorary members.

ARTICLE 6. The Society may, from time to time, appoint professors on Entomology, Botany, Horticultural Chemistry and Geology.

ARTICLE 7. This constitution may be altered or amended by a vote of two-thirds of the members present, at any regular meeting, notice of the proposed amendment, in writing, having been previously given.

ARTICLE 8. Seven members shall constitute a quorum for the transaction of business.

* Name changed at annual meeting, January 1, 1881, by vote of two-thirds of the members present to *State Agricultural Association of Pennsylvania.*

† Amended at annual meeting, January, 1881, to read: The Executive Committee shall consist of all the elective officers of this Association, and three of said committee (of which the President of the Society shall be one) shall constitute a quorum to transact any business relative to the interests of the Association.

BY-LAWS.

ARTICLE 1. The Committee on Nomenclature shall collate and decide the standard and synonymous names of all fruits known in the Society, with the authorities for each, and report, so far as practicable, at each regular meeting, and record the same in a book kept for that purpose.

ARTICLE 2. The General Fruit Committee shall carefully and thoroughly investigate the subject of fruit culture in general. Each local committee of three shall collect such useful and interesting information in relation to the subject as may be in their power, and embody the same in monthly reports, to be made to the general chairman; such reports to be by him examined and embodied in his annual and semi-annual reports. Also that the said county committee shall form *ad interim* committees for their respective counties; and further, that said *ad interim* committees are hereby authorized to publish the reports in the "*Gardener's Monthly*," or such other paper as they may select, the same having been first submitted to the chairman of the General Fruit Committee for his approval: *Provided*, That said publication shall be free of expense to the Association.

ARTICLE 3. The annual meeting of the Association shall be held on the third Wednesday of January of each year, at such a place as the Executive Committee may appoint, at which time the election for officers shall take place; said officers to serve from the close of the meeting at which they are elected to the close of the succeeding annual meeting, at which an exhibition and discussion of fruits shall take place, and other business transacted in the following order:

1st. Reading of minutes of previous meetings.
2d. Roll call and dues collected.
3d. Election of officers.
4th. Reports of officers.
5th. Reports of standing committees.
6th. Reports of special committees.
7th. Unfinished business of former meeting.
8th. New business.

The nomination and election of new members shall be in order at any time during the session.

ARTICLE 4. Other meetings may be convened by the Executive Committee at such time and place as they may appoint.

ARTICLE 5. No member who is in arrears for dues shall be eligible for any office, or serve on any standing committee; and any member who shall neglect to pay his dues shall cease to enjoy the privileges of membership.

ARTICLE 6. A library shall be established for the benefit of the members of this Association, and a Librarian elected annually with other elective officers.

Section 1. The Librarian shall keep an alphabetical record of the books, &c., and may loan to any member of this Association any books contained therein without cost: *Provided*, That it be returned within three months, and in as good condition as when received.

Section 2. Any member refusing to return to the Librarian books or reports from said library, shall pay their equivalent, or forfeit his membership.

LIST OF OFFICERS FOR 1887.

PRESIDENT.

CALVIN COOPER, Bird-in-Hand.

VICE PRESIDENTS.

JOSIAH HOOPES, West Chester.
H. M. ENGLE, Marietta.
EDWIN SATTERTHWAIT, Jenkintown.

RECORDING SECRETARY.

E. B. ENGLE, Waynesboro'.

CORRESPONDING SECRETARY.

W. P. BRINTON, Christiana.

TREASURER.

J. HIBBERD BARTRAM, Milltown.

LIBRARIAN.

THOMAS J. EDGE, Harrisburg.

PROFESSOR OF BOTANY.

THOMAS MEEHAN, Germantown.

PROFESSOR OF ENTOMOLOGY.

S. S. RATHVON, Lancaster.

PROFESSOR OF HORTICULTURAL CHEMISTRY.

S. B. HEIGES, Shippensburg.

COMMITTEES FOR 1887.

GENERAL FRUIT COMMITTEE.

Cyrus T. Fox, *Chairman*, Reading, Berks county.

COUNTY.	MEMBERS.	P. O. ADDRESS.
Adams,	J. L. Sherfy,	Gettysburg.
Allegheny,	E. P. Swift,	Mount Oliver.
Armstrong,	J. Donaldson,	Kittanning.
Beaver,	A. L. McKibbin,	Green Garden.
Bedford,	J. Z. Replogle,	New Enterprise.
Berks,	C. T. Fox,	Reading.
Blair,	F. Jaekel,	Hollidaysburg.
Bradford,	R. M. Wells,	Towanda.
Bucks,	Henry W. Comfort,	Fallsington.
Butler,	J. W. Phillips,	Zelienople.
Carbon,	E. Bauer,	East Mauch Chunk.
Cambria,	George W. Harvey,	Gallitzin.
Centre,	Prof. W. A. Buckhout,	State College.
Chester,	J. W. Pyle,	Willow Dale.
Clarion,	J. H. Patrick,	Clarion.
Clearfield,	Samuel Hall,	McGee's Mills.
Clinton,	Joel A. Herr,	Cedar Springs.
Columbia,	J. K. Sharpless,	Catawissa.
Crawford,	James Turner,	Meadville.
Cumberland,	H. S. Rupp,	Shiremanstown.
Dauphin,	Gabriel Hiester,	Harrisburg.
Delaware,	Joseph Lewis, Jr.,	Newtown Square.
Elk,	W. H. Johnston,	Benezett.
Erie,	G. A. Evans,	West Mill Creek.
Fayette,	Samuel Wakefield,	Red Lion.
Franklin,	Dr. B. L. Ryder,	Chambersburg.
Fulton,	B. C. Dawney,	Hustontown.
Greene,	L. W. Gwynn,	Carmichaels.
Huntingdon,	George W. Owens,	Birmingham.
Indiana,	J. T. Stuchul,	Indiana.
Jefferson,	S. H. Whitehill,	Brookville.
Juniata,	J. E. Jamison,	McAlisterville.
Lackawanna,	I. F. Tillinghast,	La Plume.
Lancaster,	L. S. Reist,	Oregon.
Lebanon,	Henry C. Snavely,	Lebanon.
Lehigh,	H. Leh,	Allentown.
Luzerne,	P. Sutton,	Exeter.
Lycoming,	A. R. Sprout,	Picture Rocks.
Mercer,	W. J. McKean,	Mercer.
Mifflin,	Henry Ort,	Lewistown.
Montgomery,	E. Satterthwait,	Jenkintown.
Monroe,	R. F. Schwarz,	Analomink.
Montour,	W. M. Gearhart,	Danville.
Northampton,	A. S. Shimer,	Redington.
Northumberland,	William Voris,	Pottsgrove.
Perry,	M. B. Eshleman,	Newport.
Philadelphia,	Thomas B. Meehan,	Germantown.
Potter,	A. B. Mann,	Coudersport.
Schuylkill,	Thomas Hoy,	Orwigsburg.
Snyder,	J. A. Kepler,	Mount Pleasant Mills.
Somerset,	C. C. Musselman,	Somerset.
Sullivan,	E. A. Strong,	Dushore.
Susquehanna,	Myron Kasson,	Montrose.
Tioga,	S. M. Baker,	Brookfield.
Union,	A. S. Sheller,	Lewisburg.
Venango,	J. Miller,	Franklin.
Wayne,	N. T. Underwood,	Lake Como.
Warren,	W. Cowan,	Warren.
Washington,	Pressley Leach,	Burgettstown.
Westmoreland,	A. Ruth,	Scottdale.
Wyoming,	N. A. McKown,	Tunkhannock.
York,	Peter Lint,	York.

COMMITTEES FOR 1887.

COMMITTEE ON NOMENCLATURE.

H. A. Chase, *Chairman*, Philadelphia.
Dr. J. H. Funk, Berks county.
H. A. Longsdorf, Cumberland county.
J. T. Smith, Juniata county.
Edwin W. Thomas, Montgomery county.

COMMITTEE ON ORCHARDING.

Col. George F. McFarland, *Chairman*, Dauphin county.
J. G. Engle, Lancaster county.
Jacob Heyser, Franklin county.
Edwin Davis, Juniata county.
John Hoffa, Northumberland county.

COMMITTEE ON FLORICULTURE AND ARBORICULTURE.

William H. Moon, *Chairman*, Bucks co.
P. C. Hiller, Lancaster county.
John C. Hepler, Berks county.
George Achelis, Chester county.
John C. Cullen, Northampton county.

COMMITTEE ON ENTOMOLOGY.

S. S. Rathvon, *Chairman*, Lancaster co.
Ezra High, Berks county.
Herman Strecker, Berks county.

COMMITTEE ON ARRANGEMENT AND RECEPTION.

H. C. Snavely, *Chairman*, Lebanon co.
Col. G. F. McFarland, Dauphin county.
E. B. Engle, Franklin county.

LIFE MEMBERS.

Bartram, J. Hibberd, Milltown, Chester county.
Brinton, W. P., Christiana, Lancaster county.
Calder, Rev. James, Harrisburg, Dauphin county.
Cornelius, Robert, Philadelphia.
Engle, J. G., Marietta, Lancaster county.
Engle, H. M., Marietta, Lancaster county.
Engle, E. B., Waynesboro', Franklin county.
Fox, Cyrus T., Reading, Berks county.
Garretson, Joel V., Flora Dale, Adams county.
Hayes, Charles P., 149 North Fifteenth street, Philadelphia.
Heyser, Jacob, Chambersburg, Franklin county.
Hildrup, W. T., Harrisburg, Dauphin county.
Hacker, William, Philadelphia.
Hoopes, Josiah, West Chester, Chester county.
Hiller, Casper, Conestoga, Lancaster county.
Hiller, Peter C., Conestoga, Lancaster county.
Landis, Israel, Lancaster, Lancaster county.
Martin, J. O., Mercersburg, Franklin county.
Pannebaker, William M., Lewistown, Mifflin county.
Reist, Peter S., Lititz, Lancaster county.
Scribner, Prof. F. Lamson, Washington, D. C.
Shaffner, Jacob, Harrisburg, Dauphin county.
Swift, E. P., Mount Oliver, Allegheny county.
Thomas, George B., West Chester, Chester county.
Thomas, Edwin W., King of Prussia, Montgomery county.
Van Deman, H. E., Washington, D. C.

HONORARY MEMBERS.

Barry, P., Rochester, N. Y.
Downing, Charles, Newburg, N. Y., (deceased).
Ellwanger, George, Rochester, N. Y.
Garber, J. B., Columbia, Lancaster county, Pa, (deceased).
Meehan, Thomas, Germantown, Pa.
Michener, Dr. E., Toughkenamon, Chester county, Pa., (deceased).
Parsons, S. B., Flushing, N. Y.
Parry, William, Parry, N. J.
Rathvon, Prof. S. S., Lancaster.
Rowe, Hon. D. Watson, Chambersburg, Pa.
Rutter, John, West Chester, Pa.
Saunders, William, Washington, D. C.
Stitzel, Hon. George D., Reading, Pa.
Thomas, John J., Union Springs, N. Y.
Warder, Dr. John A., North Bend, Ohio, (deceased).
Willets, Rev. Dr., Philadelphia.
Wilder, Hon. M. P., Boston, Mass., (deceased).
Wickersham, Dr. J. P., Lancaster, Pa.

ANNUAL MEMBERS.

Achelis, George, West Chester.
Albright, William B., Reading.
Ancona, Hon. S. E., Reading.
Bachman, T. F., Kreidersville.
Bauer, Elwin, East Mauch Chunk.
Baer, J. C., Hamburg.
Bickel, Isaac, Reading.
Biddle, F. C., Chadd's Ford.
Breneiser, Charles, Reading.
Breinig, John L., Allentown.
Brinser, E. C., Middletown.
Brown, J. Evans, Cranberry, N. C.
Bruckman, George W., Reading.
Buck, Aaron R., Stouchsburg.
Burkey, Joshua R., Reading.
Chase, R. G., Geneva, N. Y.
Chase, H. A., 1430 South Broad st., Phila.
Cheetham, J. H., Reading.
Clous, W. J., Reading.
Cocklin, E. H., Bowmansdale.
Comfort, H. W., Fallingston.
Cooper, Calvin, Bird-in-Hand.
Cullen, John C., South Bethlehem.
Curwen, John, Jr., Villa Nova.
Davis, E. M., 205 Walnut Place, Phila.
Davis, Edwin, Thompsontown.
Dauth, George W., Reading.
Diffenderfer, F. R., Lancaster.
Dietrich, Levi F., Reading.
Derr, Cyrus G., Reading.
Donmoyer, M. T., Kutztown.
Eby, Simon P., Lancaster.
Edge, Thomas J., Harrisburg.
Eckert, Henry S., Reading.
Engle, Daniel G., Marietta.
Endlich, G. A., Reading.
Eppihimer, Henry, Reading.
Ermentrout, Hon. J. N., Reading.
Evans, Miller M., Reading,
Faust, J. B., 921 North Third st., Reading.
Fegley, Albert H., Reading.
Fisher, W. H., Reading.
Fox, E. S., Reading.
Funk, Dr. J. H., Boyertown.
Gaul, James W., Wernersville.
Geisler, C. W., Reading.
Geiss, P. D., Bethlehem.
Getz, James K., Reading.
Goodhart, Reuben, Reading.
Gottshall, John, Reading.
Gerhart, Dr. T. S., Beckersville.
Geiger, Milton Z., Geiger's Mills.
Grant, Jeremiah K., Reading.
Greene, Dr. C. A., Harrisburg.
Greenleaf, Dr. R. P., Henry Clay, Del.
Griesemer, Charles A. Z., Reading.
Gutshall, Col. John, Carlisle.
Haines, Henry C., Germantown.

Haines, John S., Germantown.
Hart, Lane S., Harrisburg.
Hawley, Jesse G., Reading.
Hagenman, Hon. J., Reading.
Hartman, Frederick S., Tuckerton.
Heller, F. P., Reading.
Hendel, Henry B., Reading.
Hepler, John C., Reading.
Herr, Joel A., Cedar Springs.
Herr, Daniel D., Lancaster.
Hershey, Simon A., Landisville.
Hershey, W. L., Landisville.
Hertzler, S. M., Eberly's Mills.
Hiester, Gabriel, Harrisburg.
High, Ezra, Reading.
High, William R., Reading.
Hoffa, John, Milton.
Holtzman, John S., Tulpehocken.
Hylton, Dr. J. Dunbar, Palmyra, N. J.
Jaekel, F., Hollidaysburg.
Jameson, James, Reading.
Jacobs, J. H., Reading.
Jamison, J. E., McAllisterville.
Keim, Henry M., Reading.
Keim, Isaac W., Reading.
Keim, George W., Stouchsburg.
Keller, Col. D. C., Reading.
Kendig, M. D., Creswell.
Kennedy, Prof. George, Beaver Falls.
Kenny, James R., Reading.
Kepler, John A., Mt. Pleasant Mills.
Kershner, George W., Reading.
Kerst, Amos, Reading.
Kerstetter, O. S., McKee's Half Falls.
Kindt, S. S., Reading.
King, James P., Bethlehem.
Knabb, Jacob, Reading.
Koch, James, Reading.
Kready, John, Mount Joy.
Kraemer, Lewis, Stony Creek Mills.
Kuehn, David, Allentown.
Kuser, D. H. G., New Berlinville.
Lauer, George F., Reading.
Leh, H., Allentown.
Leonard, Maurice, Oakland Mills.
Lewis, Joseph, Jr., Newtown Square.
Leinbach, Joseph A., Reading.
Leinbach, George A., Reading.
Levan, Cyrus, Jacksonwold.
Linn, John, Chambersburg.
Lint, Peter, York.
Linville, J. C., Gap.
Longsdorf, D. E., Mechanicsburg.
Longsdorf, H. A., Mechanicsburg.
McFarland, Col. George F., Harrisburg.
McGowan, James, Geiger's Mills.
Maltzberger, H., Reading.
Marks, Levi, Reading.
Meehan, Thomas B., Germantown.
Meredith, S. M., Reading.
Mengel, Levi W., Reading.
Miller, Charles H., Mt. Airy, Philadelphia.
Mitchell, J. E., 310 York avenue, Philadelphia.
Moon, W. H., Morrisville.
Mohn, John G., Reading.
Moers, John F., Reading.
Moore, William G., Womelsdorf.
Moser, James K., Allentown.
Moyer, John M., Beckersville.
Murdoch, Alexander, Pittsburgh.
Muhlenburg, H. A., Reading.
Mumma, Isaac, Highspire.
Neischwander, Levi M., Hamburg.
Nimson, C. H., Allentown.
Neisley, C. B., Mechanicsburg.
Nolan, William, Reading.
Oberly, Erwin, Easton.
Ort, Henry, Lewistown.
Ort, Mrs. Henry, Lewistown.
Orth, John F., Reading.
Orr, Jesse, Reading.
O'Reilly, James A., Reading.
Phillips, J. W., Zelienople.
Phelps, George W., Reading.
Pyle, J. W., Willow Dale.
Quier, Levi, Reading.
Rakestraw, Thomas, Willow Dale.
Ralston, John, Reading.
Reist, Levi S., Oregon.
Reber, Henry C. G., Reading.
Reiger, Henry, Reading.
Rife, Jacob L., West Fairview.
Ritter, W. S., Reading.
Rupp, H. S. Shiremanstown.
Rush, J. G., West Willow.
Rollman, John, Lower Heidelberg.
Ruth, A., Scottdale.
Ryder, Dr. B. L., Chambersburg.
Ritter, Benjamin S., Jacksonwold.
Satterthwait, Edwin, Jenkintown.
Schaffer, Morris H., Reading.
Scherer, Reuben W., Manatawny.
Schock, Oliver D., Hamburg.
Schwarz, R. F., Analomink.
Shearer, E. L., Tuckerton.
Shearer, Solomon, Vinemont.
Shearer, Christopher, Tuckerton.
Shearer, E. L., Reading.
Sherfy, John L. Gettysburg.
Shearer, Joseph, Reading.
Sheller, A. S., Lewisburg.
Sharpless, J. K., Catawissa.
Shimer, A. S., Redington.
Shoemaker, R. C., Jarrettown.
Shoemaker, W. A., Reading.
Seidel, Franklin, Maiden Creek.

Small, Samuel, Jr., York.
Smith, J. T., McAllisterville.
Smith, J. H., Cocolamus.
Snavely, H. C., Lebanon.
Smith, Dr. Aaron, Reading.
Smith, F. Leaf., Reading.
Smink, F. C., Reading.
Snyder, Solomon L., Reading.
Strunk, A. S., Reading.
Stauffer, A. K., Reading.
Stubblebine, J. G., Morgantown.
Styer, Adam, Morgantown.
Stump, Henry W., Stouchsburg.
Thomas, Joseph W., King of Prussia.
Trexler, A. D., Trexler.
VanBuskirk, James, Pricetown.
Walter, Dr. Robert, Walter's Park.
Wanner, Amos B., Reading.
Wanner, Peter D., Reading.
Weiler, M. S., Reading.
Willson, George B., Lancaster.
Witmer, Joseph F., Paradise.
Williams, J. Savage, 79 Second street, Baltimore.
Wherry, S. M., Shippensburg.
Whitner, George K., Reading.
Woods, T. A., Harrisburg.
Yates, D. G., 5774 Germantown avenue, Philadelphia.
Yocum, William, Douglasville.
Young, William, Reading.
Young, John G. B., Reading.
Zeigler, Amos, Shock's Mills.
Zerr, E. M., Geiger's Mills.
Zug, Allen W., Lititz.
Zerr, Jacob G., Geiger's Mills.

very good. Ripens in August. A promising market sort.

FANNY.

Origin, near Strasburgh, Lan. Co., on farm formerly owned by Jacob Beam. Tree vigorous, spreading very productive. Fruit large, deep rich crimson, moderately sprinkled with light dots. Flesh white, tender, juicy, pleasant, sub-acid, very good. Ripens in August. A promising market sort.

STATE HORTICULTURAL ASSOCIATION OF PENNSYLVANIA.

Although not so largely attended as some of our meetings in recent years, the twenty-eighth annual session held at Bethlehem, Pa., lacked none of the interest usually manifested in our work.

The customary routine of business was promptly dispatched, and the various discussions were interesting and spirited. The president and vice presidents having failed to reach the city in time for the opening session, Colonel McFarland called the meeting to order and temporarily presided. The display of fruit was not large, but unusually fine. A collection of different varieties of oranges, contributed by Mr. E. H. Hart, Federal Point, Florida, was placed on exhibition by Mr. Van Deman, who explained some of their peculiarities. After some discussion and several ballots, Lebanon was chosen for our next place of meeting.

Among the distinguished horticultural visitors who were present and took part in our deliberations were Mr. Van Deman and Prof. Scribner, of the Department of Agriculture at Washington. Their presence added greatly to the interest of our deliberations, and they were cordially invited to meet with us again.

We are pleased to note the following additions to members for 1887:

LIFE MEMBERS.

H. E. Van Deman, Department of Agriculture, Washington, D. C.
Prof. F. Lamson Scribner, Department of Agriculture, Washington, D. C.

ANNUAL MEMBERS.

T. F. Bachman, Kreidersville, Pa.
J. Evans Brown, Cranberry, N. C.
E. C. Brinser, Middletown, Pa.
John L. Breinig, Allentown, Pa.
John C. Cullen, South Bethlehem, Pa.
P. D. Geiss, Bethlehem, Pa.
John S. Holtzman, Tulpehocken, Pa.
F. Jaekel, Hollidaysburg, Pa.
O. S. Kerstetter, McKee's Half Falls, Pa.
S. S. Kindt, Reading, Pa.
David Kuehn, Allentown, Pa.
James P. King, Bethlehem, Pa.
James K. Moser, Allentown, Pa.

THE MEETING.

In the absence of the president and vice presidents, the members were called to order at two o'clock by the secretary in the hall of the Sun Hotel. On motion of Mr. MOON, Colonel McFarland, of Harrisburg, was elected president *pro tem.* Briefly thanking the association for the honor conferred, he announced his readiness to proceed with the usual business In behalf of the citizens of Bethlehem, Mr. KEMMERER bade them a hearty welcome, in substance as follows:

Gentlemen and Members of the Pennsylvania State Horticultural Association:—In the absence of our chief burgess, the pleasant duty of extending to you, in behalf of the citizens of Bethlehem, a welcome, devolves upon me. As, by the nature of my pursuit, I am not versed in the lines of your training and research, I can tell you no great facts in the science of horticulture, yet I can assure you that I am acquainted with the fact that your association has done a great deal of good. "By their fruits shall ye know them." While we citizens are greatly in love with our towns and proud of our position in the beautiful valley of the Lehigh, of our business institutions and enterprises, and of our institutions of learning and our churches, yet I do not think I overstate the case when I say that we are still more proud of our warm hospitality to strangers. Therefore, in behalf of the citizens of Bethlehem and South Bethlehem, Old South Bethlehem and West Bethlehem, and of all the Bethlehems, I extend to you, one and all, a most cordial welcome, and trust that you will carry away with you a bounteous measure of pleasure and profit as the record of your sojourn here.

Response by Col. McFARLAND.

In behalf of the members of our State Horticultural Association, I wish to express to you our hearty appreciation of your cordial welcome. It was my misfortune not to have been present at our meeting here in 1880; but I have heard glowing accounts of the pleasant and interesting meeting held here then, and I am sure that after we adjourn we will go away from here with the same good opinion of your hospitality and with many pleasant recollections of our visit to the Lehigh valley. We feel confident that our visit here will be productive of good, and the many and beautiful specimens of fruits exhibited in this hall prove that we have come to a section of our State that is well advanced in the science of horticulture. The field for research and experiments in horticulture is a large one, seldom proving of any profit to the originator of new and valuable fruits or to the painstaking experimenter. I see members before me whose heads are silvered by work in the good cause, and who have accomplished much for the good of the cause without reaping the benefits they should. They have proven that Pennsylvania can raise fruit successfully and needs not be dependent upon our sister States for a supply. I think our institutions of learning pay too little attention to horticultural matters, leaving too much to individual effort and resources. For these reasons, we meet to exchange experiences, and I am not claiming too much in saying that our association is gaining considerable ground and doing great good in elevating horticulture to a successful and

paying basis. To the good citizens of the Bethlehems we would say that we will endeavor to conduct ourselves well, and we expect to carry away increased knowledge, as well as your regards and well wishes.

Minutes of preceding meeting read and approved.

On motion of Mr. Snavely, Mr. W. H. Moon was appointed treasurer *pro tempore.*

ELECTION OF OFFICERS.

On motion a committee of five was appointed to nominate candidates for the several offices for the coming year. The chairman being requested to name the committee, appointed the following members: H. C. Snavely, Joseph W. Thomas, Thomas Rakestraw, Thomas B. Meehan and A. S. Shimer.

REPORT OF THE SECRETARY.

Mr. President and Members of the State Horticultural Association of Pennsylvania: I take pleasure in presenting briefly my report for the past year:

New Members.

Never since the organization of our Society have we added as many members in any one year as at Reading last winter. Through the active efforts of Secretary Fox and President Stitzel, of the Berks County Agricultural and Horticultural Society, over one hundred new names were added to our list of members. Our roll of life members was also increased by two, and one new honorary member was elected.

While we refer with great pride and satisfaction to our increasing membership, we also have cause for sorrow and regret in the vacancies death has caused in our ranks since our last meeting. We have lost three active, earnest and efficient workers in A. W. Harrison, Thomas M. Harvey and S. W. Noble, and two honorary members in J. B. Garber and Marshall P. Wilder. As some action will doubtless be taken by our association before adjournment in reference to these deceased members, I need only refer to them thus briefly here.

The delay in the printing and distribution of our annual reports for 1885 was unusual, and will not likely occur again. It was not until about the middle of June that the reports were placed at my disposal, and they were then distributed as promptly as possible. Most of them were sent by freight or express to points convenient for distribution, while others were mailed direct to members. The reports for 1886 to which we are entitled, in pamphlet form, are about ready now for distribution. Those in cloth, and which include Agriculture of Pennsylvania, will also be ready shortly. I regret that we could not have ready for distribution, at least enough copies of complete reports to supply those members who are present at this meeting.

Owing to the number and length of several of the essays read at at our last meeting, more than the usual amount of matter was compiled for our annual report, and having considerable more than could be published in our allotted space of eighty pages, I was obliged to abridge and omit entirely several interesting and valuable essays which will appear in our proceedings for next year. In taking this step I consulted with, and had advice and consent of our executive committee.

In conclusion I beg to congratulate our association upon the success

which has attended the efforts of Mr. Cyrus T. Fox, the efficient chairman of our general fruit committee, in procuring reports from counties hitherto unrepresented on his committee. At our last meeting he was able to report a number of new counties in which our society had secured a foothold. At the present meeting still more are being added, and from present indications he will, a year hence, be prepared to advise us that every county in the State has at least one prompt and willing representative and correspondent, who will aid us in making the work of this association more general, more complete and satisfactory than ever before.

E. B. ENGLE, *Secretary.*

On motion of Mr. MOON, a committee of three was appointed on memorials of deceased members. The chair named Josiah Hoopes, W. H. Moon and H. Leh.

The CHAIRMAN. Owing to the absence of some of our members, it would probably be well to modify somewhat our order of business. I will be glad to hear any suggestions.

Mr. SNAVELY. In the absence of some of the older members, who usually lead in our discussions, I would suggest that some of the essays in the hands of the secretary be read.

The SECRETARY then read the following:

ESSAY ON TIMBER TREES.

By CASPER HILLER, *of Lancaster county.*

It has been a great mistake that so many of our steep hillsides have been cleared of wood and made into farm lands. These steep fields so subject to wash are becoming more unproductive and unprofitable every year, so that not many years hence they will be abandoned for agricultural purposes and then they will be an eyesore and a detriment to the farm. In fact many of our creek hills are already in that condition. Where formerly giant trees grew, there is in many places barely soil enough left to grow shrubbery. After cutting out the ripe wood, had the young trees and the sprouts been taken care of, and where necessary to fill out vacant places by judicious planting, these hillsides would to-day be the most valuable part of the farm. After all the valuable articles that are yearly given to the public on the uses of trees as shelter, influence on climate, rainfall, etc., there is very little progress made in forest planting.

The reason of this can perhaps best be attributed to

First. To the idea, that most persons have, that it takes one hundred or more years to grow a forest tree to profit.

Second. People have so little idea of what varieties should be planted to attain success.

Third. Too little knowledge of how to plant and care for trees.

I here give the growth of trees of my own planting. It may help to dispel the idea that it takes one hundred years to grow trees before they become profitable.

White pine, ...	40	years	old,	72 ins.	circumference.
Hemlock, ...	40	"	"	48 "	"
Locust, ...	40	"	"	50 "	"
Larch, ...	40	"	"	54 "	"
Walnut, ...	35	"	"	54 "	"
Sugar maple, . . .	35	"	"	42 "	"
Silver maple, . . .	30	"	"	68 "	"
Tulip poplar, . . .	30	"	"	50 "	"
Paulonia, ...	25	"	"	72 "	"
Catalpa, ...	25	"	"	45 "	"

This would show that an acre of such hillside land as I have described, planted thirty-five years ago to any of the varieties named, would to-day, instead of being an eyesore, be worth more than any other acre of the farm. From two dollars to four dollars worth of posts have been made from a locust tree thirty years old. One hundred or more such trees should be grown on an acre.

What varieties to plant. Those varieties that are most useful on the farm, and of these, fencing materials are of the most importance. For this purpose the locust, chestnut and paulonia are the most desirable. The locust in some sections is attacked by borers which destroy its value, but the paulonia can safely be substituted in its place. It will grow three posts where the locust will make one, and in lasting quality it is superior to chestnut, equal to catalpa, outgrowing the latter nearly two to one.

There is no tree that will be so soon missed as the hickory. It is not a slow grower—could be planted thickly, and the thinnings would be, in the way of hoop poles, very profitable.

The osage orange should however be planted in preference to the hickory. The wood possesses the same qualities as the hickory. Persons who never saw it growing but as a hedge plant, may be surprised to be told that if planted and cared for as a tree, it can be grown in twenty or thirty years to a tree fifteen or twenty inches in diameter, with a clean stem fifteen or more feet high. I have no experience in planting and growing trees as forests, but experienced planters in the western States say that a good way is to plant trees from four to six feet apart each way and care for them as a crop of corn until the trees are established.

The object of planting thickly is to produce upright growth instead of spreading into extended side branches which are of little value.

The process of thinning should commence in a few years, and during the first ten or fifteen years the greater part should be removed. To what extent this thinning should be carried, must be judged by the thrift of the trees. The probabilities however are that in the majority of cases one hundred trees during the second twenty years would produce better results than would a greater number.

Mr. Moon. I am surprised to hear the paulonia recommended for fencing. It is too rapid a grower to produce a durable timber.

Mr. Joseph W. Thomas. Paulonia is not a tender tree with us, and I am also surprised to see it recommended for timber. This is a very valuable essay and corresponds with our experience. Have often seen hillsides that are bare and being washed away by rains, that might be profitably utilized for timber culture. This is an important topic, and I hope to hear the views of others.

Mr. Moon. Timber culture could be made profitable by growing

locust. The data and measurements given by the essayist are interesting and valuable for reference.

Col. McFarland. Have any of you had experience as to the value of trees for shelter belts? I have been told of a gentleman who planted three belts of trees as an orchard protection. The planting of timber trees might thus be made to serve a double purpose and profit.

Mr. Linville. I fully agree with the essayist as to the injury of denuding our hillsides of forests. Left without protection they are washed and torn with gullies, that sweep away fences and deposit the soil into valleys below. With a little care and protection the chestnut, which originally covered our hillsides, would furnish valuable timber for ages. I know nothing of the value of of paulonia for timber. It grows very rapidly and straighter than catalpa.

Mr. Van Deman. If paulonia is hardy, here it would be valuable. Have often heard that rapid growing trees do not make desirable timber. Catalpa is a very rapid grower and very lasting. Osage orange is also very desirable.

In Texas, Arkansas and the Indian Territory, where grown along streams and in thick forests it makes a good post timber, but further north it is inclined to grow scrubby and the wood is not so valuable.

As to shelter belts, experience in the west has taught us that it is best to plant them on the west and south sides of our orchards in order to protect from hot winds from the south. The winter winds are severe only in the extreme north, in Dakota and Minnesota. Trees are more likely to be injured on the southern than on the northern sides of shelter belts, owing to sudden and repeated changes.

Mr. Moon. My experience confirms the views of the last speaker. It is not always the extreme cold that injures our fruit trees, but the warm days in late winter and early spring that partly expand the buds, only to be injured by colder weather that comes later.

Mr. Scherer. I have a small orchard in Oley township, Berks county, that is surrounded by a locust belt, and I believe I can raise more apples than any man in the township. I attribute my success to the protection given my orchard.

Prof. Scribner. Much depends on the latitude where grown, and what is advisable in Kansas might not do elsewhere. In my native State of Maine the winters are very cold. My orchard is largely on the south-east slope of a hill, and there is not another in the State that has produced larger crops of fruit. It is protected on the north by a forest and on the west by a white cedar hedge, which makes a very dense and valuable shelter. A neighbor's orchard is protected by a hedge of white pine, which was said to be difficult to establish, but in ten years grew to be twenty feet high. It is the practice in Maine to shelter orchards, and I believe it brings good results. I would, however, not advise the use of red cedar, as it carries a fungus which is injurious to apple trees.

Mr. Van Deman. So far as my observation and experience go, a wind-break on the west is no disadvantage, but the most essential point is protection on the south and south-west. The same rule may not apply in this latitude.

Col. McFarland. In the counties of Blair and Cambria, in every sheltered nook they have unfailing crops of apples, which I attribute to the sheltered locations.

The following essay was then read by the secretary:

PROSE AND POETRY OF GARDENING.

By Mrs. HELEN V. AUSTIN, *Johnstown, Cambria county, Pa.*

To the President and Members of the State Horticultural Association of Pennsylvania: That I should come before this august body of horticulturists with an essay, and on a theme like this, seems almost like presumption. I am pleased to note that your association has so steadily maintained its importance and diffused its influence far beyond the geographical boundaries of the State, and I frankly confess that the more I contemplate my subject, in order to cull a few central ideas relating to it, the broader and wider and deeper it seems; and the more I endeavor to draw a line between prose and poetry, the more they seem to blend; so that if I merge them together it will be because they are inseparable. What a happy occupation that must be where toil and care and painstaking are softened and refined by the genius of beauty and harmony; where the spirit of poetry makes sweet the path of labor and dignifies the commonest things.

The very name of your society has a symphonious sound—Penn's sylvania. And it was according to the principle of the "fitness of things" that when Penn made the purchase of these "woods" that he held his treaty with the Indians under a spreading tree. Perhaps the red chiefs would have disdained to have held the treaty anywhere else, for the Indians reverence nature.

Horticulturists are prone to go back to the garden of Eden and speak of the first occupation of mankind; and, according to Mr. Roe, it is a good thing to be "driven back to Eden." In the grand, old beginning, when mankind was sinless, before death came into our world and all our woe, the garden must have been perfection. It must have been all that our purest taste and finest imagination can picture, a garden of delights, a paradise indeed.

In contrast with the garden away back in the beginning we might place some that our eyes have beheld—the garden of the sluggard. I have not time now to describe it, if I had the heart. It is enough to convince the beholder of the fall of man, if there were no other evidences. This "total depravity of an inanimate thing," corresponds to the total depravity of the owner. But, no, we must not be too rash in judgment, for even the weeds in a neglected garden will have their beauties; will creep and twine and frolic; vines will swing in graceful festoons and arches, and cover up deformities, wild flowers and flowers run wild, will blossom and feed the bees, and the birds will build their nests in the briars, and songs and sweetness will flood the air. So with the owner, he cannot be totally depraved; he has some sweet spots, some kindly corner in his heart, some dreams of a perfect garden, otherwise, he would not have a garden at all.

But there is one image of a garden in the mind of every one of us that is more precious than our most vivid imaginations of the garden of Eden, because it is sacred to memory. It is the old-fashioned garden of the mothers of our horticulturists. Oh, the old-time flowers that grew in the garden when we were children! The long ribbons of many colors that extended through the middle of the vegetable garden, on either side of the broad walk. Such pinks and tulips and lilies as we had then! with all the rest of the procession of flora, from

the first quaint little things that came up at the early call of spring, to the latest lark-spur and chrysanthemums that only deepened their hues before they yielded to the icy breath of winter.

The old-fashioned mothers have left their impress on the age; their genius for gardening has descended to their sons, and wonderful things are now done in all departments of horticulture which well may astonish those of kindred taste in the old world. But here, pardon the strictures of one who cherishes the "love of life's young days" for the old-fashioned flowers. Professional florists, in their zeal to excel and to satisfy the demand for "something new," seem endeavoring to outdo nature. If it were not that nature is true to herself and will go back to first principles, if let alone, and cannot be out-witted—if she appears sometimes to be out-done—we would have but few old-fashioned flowers left; the real characteristics, distinctness and simplicity of many flowers is destroyed by the interruptions of scientific fingers. Science has come along in a prosy, cold-blooded way and taken the poetry out of them. Just think of what you have done to the old-fashioned "lady's slipper," or "touch-me not," ye flower menders! You have obliterated the form of the quaint little slipper, and as for the characteristics of the seed-pod, since you have changed the name, there is scarcely a child now who ever attempts to touch the pod and test the magical spring, and for a substitute for the name which had significance, you have given the flower the unmeaning name of *Balsam.* But you have a double flower which bears some resemblance to a rose, and is useful when making up "designs" for some "big show" at funerals or elsewhere. From a commercial point of view, however, the balsam is a success name and all.

Then, there is the Petunia. The "single" petunia is chaste and graceful and a constant bloomer, the double petunia is a bulging, overgrown mass of bloom. And the double tiger lily—it may be something rare to possess, but it is a monstrosity. The "double" in the tiger lily is an intrusion and impertinence, and, who that ever really admired a pure tiger lily would stop to take a second look at one that was double.

But if science will only let the morning glories alone and the white lilies and not hybridise the golden rod and wild asters we will forgive about the touch-me-nots.

And then, too, for all of the new roses we are grateful, especially as we know that "a rose by any other name" would still be a rose. But who does not appreciate this sentiment of Oliver Wendell Holmes: "I love the damask rose best of all. The flowers our mothers and sisters used to love and cherish, those which grew beneath our eaves and by our doorsteps are the ones we always love best."

The spirit of poetry is demonstrated in that which is termed landscape or picturesque gardening. The inspiration which guides man in this art to-day is wafted down through the ages from the ancient Hanging Gardens of Babylon. What weariness and toil, what dull prose of labor entered into the construction of that triumph of horticultural art! and yet, a poetic fancy was the main spring which kept the wheels in motion; for the Queen pined for mountain scenery, mountain trees and vines and flowers, and so, this picturesque garden, this one of the seven wonders of the world, was to her a constant reminder of her childhood's home.

It is a matter of much satisfaction that the American taste in landscape gardening avoids that stiffness and regularity which once pre-

vailed in Europe, when trees were cut in the shape of pyramids, haystacks, animals, etc. The essays on gardening contained in the *Spectator* make allusion to the fancy of the time, from which it may not be unprofitable to quote: "Our English gardens are not so entertaining to the fancy as those of France and Italy, where we see a large extent of ground covered over with an agreeable mixture of garden and forest which represents everywhere an artificial rudeness, much more charming than that neatness and elegance which we meet with in those of our own country. It might, indeed, be of ill consequence to the public, as well as unprofitable to private persons, to alienate so much ground from pasturage, and the plough in many parts of a country that is so well peopled, and cultivated to a far greater advantage. But why may not a whole estate be thrown into a kind of garden by frequent plantations that may turn as much to the profit as to the pleasure of the owner? A marsh overgrown with willows, or a mountain shaded with oaks, are not only more beautiful, but more beneficial than when they lie bare and unadorned. Fields of corn make a pleasant prospect, and if the walks were a little taken care of that lie between them, if the natural embroidery of the meadows were helped and improved by some small additions of art, and the several rows of hedges set off by trees and flowers, that the soil was capable of receiving, a man might make a pretty landscape of his own possession.

"Writers who have given us an account of China, tell us the inhabitants of that country laugh at the plantations of our Europeans which are laid out by the rule and line; because they say, any one may place trees in equal rows and uniform figures. They chose rather to show a genius in works of this nature, and therefore always conceal the art by which they direct themselves. They have a word, it seems, in their language, by which they express the particular beauty of a plantation that thus strikes the imagination at first sight, without discovering what it is that has so agreeable an effect. Our British gardeners, on the contrary, instead of humoring nature, love to deviate from it as much as possible. Our trees rise in cones, globes and pyramids. We see the marks of the scissors on every plant and bush. I do not know whether I am singular in my opinion; but for my own part I would rather look upon a tree in all its luxuriance and diffusion of boughs and branches, and when it is thus cut and trimmed into a mathematical figure, and cannot but fancy that an orchard in flower looks infinitely more delightful than all the little labyrinth of the most finished *parterre.*"

And Pope, who put his theory into practice in the taste displayed in the garden of his villa at Twickenham spared not to sharply criticise the prevailing style of landscape gardening in his day:

> "Something there is more needful than expense,
> And something previous even to taste—'tis sense;
> Good sense, which only is the gift of Heaven;
> And, though no science, fairly worth the seven;
> A light which in yourself you must perceive;
> Jones and Le N'otre have it not to give.
> To build, to plant, whatever you intend,
> To rear the column, or the arch to bend,
> To swell the terrace or to sink the grot,
> In all, let nature never be forgot."

Gardening as an occupation for women is a subject which claims attention most earnest, of all who feel the necessity for more out-door

labor for women. We can only merely glance at this subject now. There are thousands of women in the over-crowded cities to-day, who are sinking into untimely graves, who could be happy and living comfortably if engaged in gardening. How pathetic is that strain in the wail of her who "sang the song of the shirt:"

"While underneath the eaves
The brooding swallows cling,
As if to show me their sunny backs
And twit me with the spring."

Mrs. Martha Logan, of South Carolina, was a great florist, and wrote her "Treatise on Gardening" at the age of seventy. And Mrs. J. C. Loudon, sharing in her husband's tastes and pursuits, has written much for woman. Among her books she has published "Practical Instruction in Gardening for Ladies," "The Lady's Flower Garden" and "Philanthropic Economy or Philosophy of Happiness."

In contrast with the gardens of the "professionals," we are apt to ignore the more humble gardens, the little spot of ground where the vegetables for family use are grown and where the familiar flowers bloom. Every family should have a garden. Even in cities there should be room for each family to have at least a little spot for flowers. Plants and flowers are "object lessons" whereby children are taught of nature by nature itself.

And why should a well kept vegetable garden be esteemed an unsightly place and unpoetic spot? Beans (especially the vining sorts), peas, melon and cucumber vines, cabbage, asparagus, lettuce and carrots are all beautiful; and Indian corn, its very appearance upon the earth is enveloped in the poetry of a myth. Hiawatha, while fasting and praying to the "Master of Life," thus first beheld the Indian corn:

"And he saw a youth approaching,
Dressed in garments green and yellow,
Coming through the purple twilight,
Through the splendor of the sunset;
Plumes of green bent o'er his forehead,
And his hair was soft and golden.
Standing at the open doorway,
Long he looked at Hiawatha,
Looked with pity and compassion
On his wasted form and features,
And in accents like the sighing
Of the South wind in the tree tops,
Said he, 'O, my Hiawatha!
All your prayers are heard in Heaven,'
* * * *
Tall and beautiful he stood there,
In his garments green and yellow;
To and fro his plumes above him
Waved and nodded with his breathing.
* * * *
"From the Master of Life descending,
I, the friend of man, Mondamin."

After Mondamin was buried, day by day did Hiawatha go to wait and watch beside it,

"Till at last a small green feather
From the earth shot slowly upward,
Then another and another,
And before the summer ended
Stood the maize in all its beauty,
With its shining robes about it,
And its long, soft yellow tresses;
And in rapture Hiawatha
Cried aloud, 'It is Mondamin!
Yes; the friend of man, Mondamin.'"

Horticulture has been termed the poetry of agriculture, and may we not call Flora culture the "poetry of gardening?" Aside from commercial worth, who could estimate the value of flowers to the universal heart of humanity. Flowers give expression to the affections and emotions of the heart which words cannot express. "Heaven lies about us in our childhood." Therefore every child loves flowers. On every occasion, from the cradle to the grave, flowers are the symbols of our best affections and religious devotion and hope of eternal life. One of the most touching pictures I ever saw was entitled "The Last Token." It was a white rose, thrown from the gallery by a lover to the feet of a maiden, a Christian martyr in the arena, who was about to be devoured by a lion.

That which is termed the flower mission is a beautiful expression of human sympathy, and that love, without which, we are but "sounding brass and tinkling cymbal." It will surely be a benediction which shall continue as a star in a crown forever, when the Lord shall say, when we are summoned to his judgment seat: "I was sick and in prison and you comforted me; for inasmuch as you did it unto one of the least of these you have done it unto Me." The story of Picciola is more than fiction. By its own sweet life it taught the skeptical prisoner of immortality and faith in the Creator. Many a simple flower has had its mission whose history has not been recorded farther than in the mind of the recipient.

The human heart is ever craving for rest and peace, despite the restlessness and strife of the battle of life. There comes a time in most lives when the great world is of little consequence, and we draw nearer and nearer to the old nurse, Nature. Then, if never before, shall one's own vine and fig-tree yield grateful shade and fruit, and the birds sing in the branches. Prose and poetry shall blend together to remind us that we are still human and must bear a part in life and fill our hearts with music, and with the poet we will say:

"Ply, Vanity, thy winged feet!
    Ambition, hew thy rocky stair;
    Who envies him who feeds on air
The icy splendors of his seat?

Let such as love the eagles scream
    Divide with him his home of ice;
    For me shall gentler notes suffice,—
The valley song of bird and stream.

The pastoral bleat, the drone of bees,
    The flail-beat chiming far away,
    The cattle low at shut of day,
The voice of God in leaf and breeze!

Then lend thy hand, my wiser friend,
    And help me to the vales below,
    (In truth, I have not far to go,)
Where sweet with flowers the fields extend."

THE "HATCH" BILL.

The Chairman read the list of topics and asked for information concerning the "Hatch" bill.

Mr. VAN DEMAN. This bill is being very thoroughly discussed in Congress, especially in the House, and it is supposed, will pass. If the members of this Society approve the bill, and wish to see it pass, it would be well to have it read.

On motion of Mr. COMFORT the bill was read by the Secretary.

A bill to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July 2, 1862, and of the acts supplementary thereto."

LOCATION OF THE STATIONS.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid the Department of Agriculture in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, in connection with the college or colleges in each State established, or which may hereafter be established, in accordance with the provisions of an act approved July 2, 1862, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, or such college which has been or may hereafter be established and operated under the laws of any territory in conformity with the provisions of this act, a department to be known and designated as an "agricultural experiment station:" *Provided*, That in any State in which two such colleges have been or may be so established, the appropriation hereinafter made to such State shall be equally divided between such colleges, unless the Legislature of such State shall otherwise direct.

OBJECTS OF THE STATIONS.

SECTION 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation within the isothermal limits represented by the climate of the several stations and their vicinity; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches and experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States and territories.

SECTION 3. That the said experiment stations shall be under the direction and control of the trustees or other governing body of such colleges, who shall have power to appoint a director and such assistants as may in each case be necessary.

UNIFORMITY OF WORK.

SECTION 4. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner of Agriculture to determine annually a standard of valuation of the ingredients of commercial

fertilizers, upon which the analysis of such fertilizers, as far as made by said stations, shall be based; to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act; but nothing herein contained shall be construed to authorize said commissioner to control or direct the work or management of any such station except as to the standard of valuation of commercial fertilizers. It shall be the duty of each of said stations, annually, on or before the first day of February, to make to the Governor of the State or territory in which it is located, a full and detailed report of its operations, including a statement of the receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said commissioner of agriculture, and to the secretary of the treasury of the United States.

PUBLICATION OF RESULTS.

SECTION 5. That in order to make the results of the work of said stations immediately useful, they shall publish at least once in every three months bulletins or reports of progress, one copy of which shall be sent to each newspaper in the States and territories in which they are respectively located, and to such individuals actively engaged in farming as may request the same, and as far as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster-General may from time to time prescribe.

APPROPRIATIONS—HOW SPENT.

SECTION 6. That for the purpose of paying the salaries and wages of the director and other employés of said stations and the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of $15,000 per annum is hereby appropriated to each State and territory, to be paid in equal quarterly payments, on the first day of January, April, July and October in each year, to the treasurer or other officer duly appointed by the aforesaid boards of trustees to receive the same; the first payment to be made on the first day of July, 1886; but no such payments shall be made to any station until the trustees or other governing body of the college at which such station is located shall have executed, under their corporate seal and filed with the secretary of the treasury of the United States an agreement to expend all moneys received under this act for the sole and exclusive purpose and in the manner herein directed, and to maintain a farm of at least twenty-five acres in connection with such college, and shall also have executed and filed with said secretary their bond, in the penal sum of $15,000 with two sufficient sureties, approved by the clerk of a court of record in such State or territory, conditioned on the faithful expenditure of and accounting for all money so received: *Provided, however*, That out of the first annual appropriation so received by any station, an amount not exceeding one-fifth may be expended in the erection, enlargement or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

MONEY DEDUCTED.

SECTION 7. That whenever it shall appear to the secretary of the treasury, from the annual statement of receipts and expenditures of any said station that a portion of the preceding annual appropriations remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SECTION 8. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States and territories in which they are respectively located.

Mr. SNAVELY. I understand, in case the bill would pass, that the station in this State would be located in Centre county.

Mr. COMFORT. Can any of our members point out instances where "experiment stations" have proven beneficial? There are so many different soils and conditions to be considered that it seems impossible to secure any reliable data.

Mr. SNAVELY. If I am correctly informed experiments are now being made by the State College.

Col. MCFARLAND. If conducted according to the provisions of this bill, experiments would, if made on the same line of work, be more uniform and valuable.

Mr. MOON. This matter is yet in its infancy, but I believe will result in good. There are thousands of dollars spent annually by the government for purposes much less worthy, and a few thousand spent for the benefit of agriculture would be well invested.

Mr. LINVILLE. No doubt much of the objection to this bill arises from the conviction that the agricultural college in this State has not proven a success. However, there has been much improvement there. Some valuable experiments have been made in our agricultural colleges, and, if properly conducted, many interesting facts can be worked out and determined that will greatly benefit farmers and horticulturists. I suppose another object of the bill is to devise some way of expending our surplus revenue.

Col. MCFARLAND. If properly conducted much valuable information can be collected at these "experiment stations" that cannot be gotten in any other way. Observations have been made as to coming changes in the weather that have been the means of saving much valuable property on sea and land. When we are warned of approaching storms we can often remove crops or secure our buildings from injury. Fertilizers can also be tested and their adaptation to certain soils ascertained. At our own "agricultural college" there has been much bad management, and as a State we have had occasion to be ashamed of it. New York has a well conducted and valuable "experiment station" while we have frittered away our opportunities by careless management. In my own opinion this bill would benefit us in many ways, and I hope we will encourage its passage. Of course there will be some mistakes made, but in a general way it will do much good. I hope we will do nothing to discourage the passage of this bill, but will be only too glad to give the government an opportunity to spend some money for the benefit of agriculture and horticulture.

Mr. COMFORT. I move a committee of three be appointed by the chair to whom this question be referred.

Adopted, and Messrs. Comfort, Moon and Snavely were appointed, with instructions to report at a later session.

REPORTS OF SPECIAL COMMITTEES.

PEACH YELLOWS AND SPECIAL MANURES AS PREVENTIVES.

Mr. SATTERTHWAIT. As chairman of this committee I did not know that the clause had been added in reference to special manures. I have but little to report. I wrote to the department at Washington to ascertain what, if anything, had been done on this subject. I received a report containing several pages written by Mr. Saunders, who is good authority. He repudiates the idea that yellows can be cured by any application, in which I agree with him. It is a specific disease for which there is no cure. One point to be remembered is that there is no "yellows" south of a certain latitude. Mr. Saunders confirms this view and goes on to say that he has noticed orchards in New Jersey and in this latitude that were very healthy, but that after a severe winter yellows gradually developed. From this fact he inferred that climatic influences were the chief causes. It is a specific poison that is contagious, and my observation is that no application to the soil will be of any benefit. We have never had much practical information on this subject from the department at Washington, but more attention to horticultural matters is now promised and some valuable results may be expected.

On motion Mr. Satterthwait's committee was continued.

Mr. THOMAS. We have on our programme a paper on the subject of peach culture and yellows, by Mr. Smith, of Juniata county, who is a practical peach grower. I suggest that before discussing this question further this essay be read.

A motion to that effect having been made and carried, the following was read by the secretary:

PEACH CULTURE AND TREATMENT OF YELLOWS.

By J. F. SMITH, *McAllisterville, Pa.*

We have been requested by your worthy secretary to give our experience in growing peaches, our location, planting and after treatment. Also our mode of marketing the fruit. We feel our inability to do justice to this very important subject.

There are a few things, however, that we have found essential to making peach-growing a success in our locality, viz: good location, good trees and varieties, deep planting, proper cutting back, good cultivation, keeping clean of borers and the removal of all trees affected with yellows within twenty-four hours after they are discovered.

First, we will endeavor to give you an idea where we are located. We are situated in Juniata county, Pennsylvania, ten miles east of the Juniata river, our valley runs east and west. North of us is the

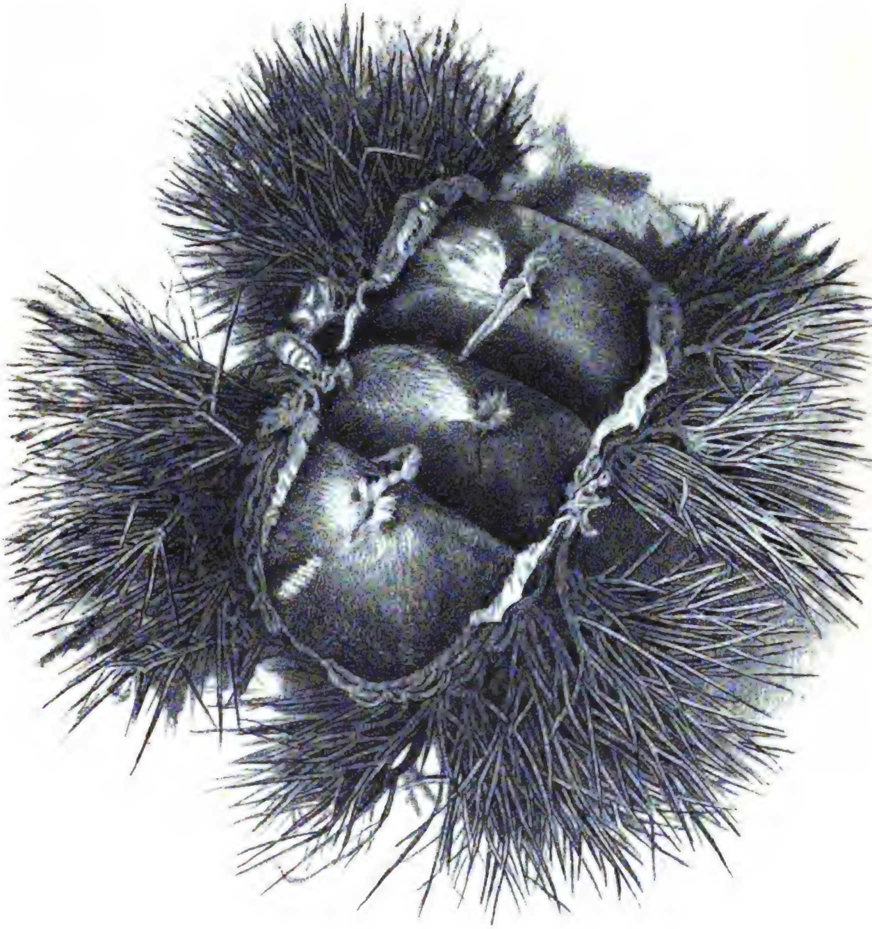
Shade mountain, with an altitude of about 500 feet, next to this mountain there is a ridge about 150 or 200 feet high, with only a narrow valley lying between it and the mountain. On the top and southern slope of this ridge we find our best locations for growing peaches. This ridge contains fossil iron ore in abundance. The soil is a light gravel, and some of it very stony and a dark loose soil.

The timber consists of rock-oak, black-oak, white-oak, pine, hickory, and chestnut. The principal orchards in this section are planted on this ridge, although there are some planted on adjoining ridges that are doing very well.

But peaches to succeed well in our section must be planted on high ground. In the spring of 1872 we planted our first orchard of 900 trees, and in 1876 we harvested 1,600 crates of peaches from the same, this being the first crop. This orchard was planted on land that had been cleared fifty or sixty years before, and had been farmed a number of years. Then it was allowed to grow up in scrub pines, some of them being six inches in diameter. We chopped off the pines, pulled the stumps, plowed the ground deeply and applied fifty bushels of lime to the acre. On the ground thus prepared we planted peach trees, and cultivated potatoes two years in the orchard, after this we cultivated the ground but raised no crops thereon.

We planted the trees sixteen feet apart each way, and dug the holes eighteen inches deep and eighteen inches square, putting the top soil on one side of the hole and the lower on the other. Before we plant the trees we see that the borers are very carefully taken out and all the broken and bruised roots are trimmed off. Then we fill the hole with top soil until the tree will stand about three inches deeper than it stood in the nursery. In most instances deep enough to cover the connection where they have been budded. We find that trees planted in this manner are more easily kept clean of borers than those that are planted more shallow.

Also the large roots are less frequently torn up by coming in contact with the plow. Nurserymen generally do not recommend deep planting, but with deep plowing before and after planting we have found it to be much the best. After the trees are planted we trim off all the branches and cut the top down two and one-half to three feet. We do more summer pruning than most of the peach growers in our section. In June or July we remove all the young shoots or branches except three or four around the top of the stem. We prefer only three if they are divided so as to make a well-balanced top. In good soil and with good cultivation, those branches will grow three to four feet the first season. The following spring we cut back those branches from eight inches to one foot, this being essential to making a well-shaped top. Some time in May or June we remove all the young shoots again from those branches, leaving only five or six shoots on the top, or about two on each branch, being careful to have them equally divided over the top. With good care and cultivation those shoots will grow from four to six feet this season, and we have grown them as long as seven feet. The following spring we cut back about one-third of this growth and thin out a few of the branches. After this we cut back only the leading branches and thin out enough to keep an open, well-shaped top. We have occasionally applied salt and saltpeter to our trees in the following manner: To five gallons water add one pound saltpeter and one pint of salt. Apply in June or July one quart of this solution to each tree, pouring it against and



BURR OF "GREAT AMERICAN" CHESTNUT.

FROM A PHOTOGRAPH.

"GREAT AMERICAN" CHESTNUTS.
FROM A PHOTOGRAPH.

around the trunk. This has a very desirable effect, and we believe it destroys some of the borers and their larvæ.

We do not depend on this, however, to keep the trees clean of borers, and we go over our orchards spring and fall carefully and take them out.

Next in order is cultivation. By some peach growers this is supposed to be of little importance. We beg leave to differ with them. Here in our locality a man would far better present the nurseryman with his money, than to take his trees and plant them and neglect to cultivate them. As well could a farmer expect to receive a good crop of corn without cultivation, as a peach grower to plant peach trees and not cultivate the same and expect a good crop.

A peach orchard should be plowed every spring as soon as the ground is fit to work in, and then cultivated three or four times during the summer to keep down weeds and the soil loose.

There are more failures in our county, resulting from poor cultivation, than from the yellows. There are thousands of trees planted that will never pay the planter, mainly from this cause.

The yellows are a great obstacle in the way of peach culture, but poor cultivation will do more to prevent the success of the grower. The yellows we treat in the following manner: As soon as we are certain that a tree is infected we remove it, root and branch, and by the strict observance of this rule we can prevent any serious loss. We have one orchard containing 1,100 trees planted nine years ago, and we are satisfied that we bought the yellows with the trees. We took out two or three trees the second summer and two more when they commenced to bear, and up to this time we have taken out thirty or thirty-five trees, a loss of about three per cent. in nine years. In regard to a cure for the yellows we know of none, but have experimented with a great many different cures and have found nothing so effective in prolonging the life and vigor of a tree as salt and ashes sown broadcast under the trees. The orchard referred to above consisted of the following varieties: Old Mixon, Stump, and Crawford's Late. It bore when four years old 1,800 crates of peaches. The next year 1,400 crates, the year following a great many of the buds were frozen which cut crop down to 600 crates. The next season we had 800 crates, and last season 1,600 crates, making an aggregate of 6,200 crates. Thus you can observe that the orchard bore the ninth year only 200 crates less than the crop at the fifth year, and the orchard is still in apparently good condition and can yield several more good crops. We expect an orchard to be profitable about ten or twelve years with good care and cultivation. We present this to you merely to show you that an orchard can be made profitable for quite a number of years if properly cared for.

When we planted our first orchard we planted the following varieties, viz: Hale's Early, Troth's Early, Mt. Rose, Red Rareripe, Crawford's Early, Old Mixon, Stump the World, Crawford's Late, Smock and Salway. Now we plant nearly all of the two last-named varieties; we found them the most profitable for our locality, for the following reason at their time of ripening here the peaches in the east have all been marketed, consequently we get from $2 00 to $4 00 per crate for them in the eastern market. There have been a great many of the earlier varieties planted here but the varieties planted here now are about three-fourth Smock and Salway.

There are about 100,000 trees planted in Juniata county of which

we have 7,000 ourselves. A great many of the trees planted here will not be profitable to the planter for the simple reason that they have not been properly pruned. The cultivation as the borer has been neglected, they having been poorly planted, &c., and the result is obvious. Any one of the above reasons is sufficient to mar the success of the grower.

We shipped last season over four thousand crates of peaches, we ship in seven-eighth bushel crates, generally shipping west by freight and east by express, those shipped west are generally sold to dealers.

About one month before the first ripening we make an estimate of the number of crates we will have of each variety, then we go to Altoona for instance, and find out who the responsible parties are that handle fruit in that place, we sell them a certain number of crates of each variety, to be delivered as they ripen, and in this manner we proceed until they are all sold. In small towns we sell to one party, agreeing to sell to no one else in the place. Persons inquiring for peaches from such places are simply referred to the party handling our fruit in the place.

We shipped peaches to the following places last season: Lewistown, Milroy, McVeytown, Newton Hamilton, Tyrone, Huntingdon, Altoona, Johnstown, Uniontown, Huntingdale, Phillipsburg, Clearfield, Bellefonte, Newport, Harrisburg, Pine Grove, Tremont, Pottsville and Philadelphia.

Our mode of selling may not prove interesting at all, but we have been asked quite frequently in regard to it by different members of the association, and we take this opportunity of giving them the desired information. From the above you will observe that we have shipped to a few of the large cities only, and to but a small number of the smaller towns that we could reach with our fruit; we have not shipped as far west as Pittsburgh, a market that would consume thousands of crates of peaches. We present this to your minds merely in order to confirm our belief that the business is not so easily overdone as a great many suppose. That some growers fail in getting their fruit to market in good condition is an undisputable fact, and one of no rare occurrence, yet this is no proof that there is a deficiency in the market for good salable peaches. It is our belief that there can be a market found for all the peaches that we can raise for a number of years yet. Not all at fancy prices, but at prices that will be profitable to the grower. Looking up the market and getting the fruit there in good condition is a very important feature in the peach business. Peaches being a perishable and delicate fruit, it is important that they be handled with the greatest care and reach a market in the least possible time in order to bring the best price.

A MEMBER. How deep do you usually plant?

Mr. SMITH. About three inches deeper than the tree stood in the nursery. I usually plant deep enough to get the point where bud and stock unite, under ground.

Mr. MEECH. I am much pleased with the essay, which is a very practical one. I agree with his views as to planting deeper than the trees stood in the nursery. This is a good idea with trees that are grown from cuttings, so as to get a new set of roots. I have made quince culture a specialty, and have always found it an advantage to plant deep. I know of an instance where a yard in which a quince tree stood, was filled up three feet, and two years ago the tree bore

fifteen bushels of fruit. Peach trees are being largely planted in New Jersey, and are proving a profitable crop.

Colonel McFARLAND. I would like to ask Mr. Smith what trimming he recommends after the third or fourth year.

Mr. SMITH. We cut back only the leading branches. When eight or nine years old we cut back into the old wood, so as to force a young growth of wood for bearing.

Mr. MEECH. Cutting back the branches year after year is the cheapest method of thinning the fruit.

Mr. SMITH. I think deep planting offers some advantage in keeping out borers. We usually hunt them in May and October.

Mr. SATTERTHWAIT. The egg which produces the borer is never laid earlier than June 1. From then to August 1, and they never hatch before August. It is best to examine the trees two or three times from August to November. If not removed they will do some injury during the winter.

Mr. VAN DEMAN. The best plan is to "bank up" the trees several inches in the spring, so as to compel the insect to deposit its eggs higher up. By digging the soil in the fall the borers can easily be found.

Mr. ENGLE. There are methods said to be just as effective that are less trouble. Mr. Hiller's method is to apply a wash of lime and cow manure. It is claimed the eggs will not develop where lime is applied.

Mr. SATTERTHWAIT. I doubt the efficacy of this remedy. The insect will make a hole and deposit its eggs under the whitewash.

Mr. VAN DEMAN. Professor Riley says homemade soft soap is the best preventive of all kinds of borers. The same has been my experience. It should be made as stiff as possible and applied in the branches, where the rains can wash it down.

Mr. ENGLE. Would not whale oil soap do?

Mr. VAN DEMAN. Professor Riley says whale oil soap is no better than homemade.

Mr. SMITH. I have applied all these remedies and still have a few borers.

Mr. SATTERTHWAIT. These remedies no doubt do some good, but they take more time than is required to take out the borers.

Mr. ENGLE. I think at a former meeting Mr. Smith said he had cured a case of yellows. Would like to hear from him on that subject.

Mr. SMITH. I believe I never succeeded in effecting a cure.

Professor SCRIBNER. As to "peach yellows," Commissioner Colman has the subject under consideration, and if an appropriation is granted, the matter will receive the attention it deserves. The range of the disease is a wide one, and the question is now before Congress.

Mr. VAN DEMAN. Colonel Colman and self have frequently discussed this subject, and he is deeply interested in it. Prof. Scribner is the micologist of the department, and if the necessary funds are provided the matter will be carefully investigated. There can be but little done in the way of a preventive or cure for yellows until the predisposing cause is discovered.

Mr. ENGLE. One of the first evidences of the disease is premature ripening of the fruit, and when it has reached this stage the tree will never recover. There are doubtless earlier symptoms, but I have never noticed them. When premature ripening of fruit occurs, the cambium

is always more or less colored. Prof. Penhallow claims he can tell the first symptoms.

Mr. MEECH. The first visible symptoms are premature ripening of fruit on one or more branches of the tree. The following year several other branches, or the entire tree may be thus affected, and by another season a number of trees may have the disease. There is also a peculiar calico-like mottling on the surface of the peach, that is an unmistakable sign of yellows. I think the only cure is to dig them out and make a bonfire of the trees, root and branch. Some three years ago a writer in the *Maryland Farmer* claimed that yellows was caused by an insect on the tips of the branches.

Mr. SATTERTHWAIT. While we are much in the dark as to the cause of the disease, there is no doubt as to the symptoms. We would like to know just what this poison is, how developed and transmitted from tree to tree, and how to prevent it.

Mr. ENGLE. I am still pursuing the experiment I referred to at our last annual meeting, to ascertain whether peach when budded on plum, will take yellows. I have, for the fourth time, budded from peach trees infected with yellows, on a tree of Blackman Plum, but thus far neither buds nor tree upon which they are growing show any symptoms of the disease. I propose to still further experiment in this direction.

Mr. COMFORT. Can peach be grafted on plum?

Mr. ENGLE. They can easily be budded, and I suppose, can also be grafted.

Col. McFARLAND. These are valuable facts that would scarcely have have been brought out through set speeches.

Mr. MEECH. I wonder how many of our members know the moths of the peach and apple borer when they see them?

The peach borer resembles the wasp in general appearance, and has two bands around its abdomen.

Mr. SATTERTHWAIT. I have never seen the beetle of the apple borer, or moth of the peach borer, except when about ready to come out.

Mr. VAN DEMAN. I have caught both on trees.

At this juncture President Cooper arrived, and was called to the chair. After a brief apology for not getting to the meeting earlier, he announced that he was ready to go on with the business before the society. He stated that he had a communication bearing on the question under discussion from Mr. Hiller, which it might be well to have read now.

The following paper was read by the society:

PEACH TREES ON PLUM STOCKS.

By CASPER HILLER.

Can the State Horticultural Society endorse the claim that has been advocated within a few years, "that peach trees grown on plum stocks of the wild goose type, are free from the attacks of the borer and exempt from the yellows?"

Should this claim prove correct it would revolutionize peach growing. As far as the borer is concerned, I think the claim will hold nearly or quite good. To claim that they will be yellows-proof,

smacks a little of the tree agent. There appears to be no philosophy in it. Shakespeare puts it into the mouth of one of his characters: "There is more in heaven and earth, Horatio, than is dreamt in your philosophy." I laid philosophy aside and last spring planted one hundred and fifty one-year-old trees that were grown in Alabama. These gave as much satisfaction in health and vigor of growth as any peach I grew in my forty years' experience. That's all there is of it so far. Will from time to time report progress. Should there be any gain in using these plum stocks, it will be important that we have a strong growing type. Wild-goose seedlings are not all equally strong growers. The Blackman is the ideal. As I never saw or heard of any one that saw the fruit, we cannot depend on raising seedlings from it. The Blackman is an enormous grower—outgrowing the peach. Can it be grown from cuttings?" A Mr. McLendon, of Thomasville, Ga., offers to grow plums from cuttings. He claims to have grown from ten-inch cuttings, planted 15th of last March, plants from three to eight feet high, and that seventy or more per cent. grew.

President COOPER. If we can use plum stocks on which to work the peach, we may be able to get rid of "yellows." Would like to know whether anyone has had experience in this direction.

Mr. SATTERTHWAIT. The plum is not safe from borers and I doubt whether it will be free from yellows.

Mr. VAN DEMAN. I fear anyone expecting to grow fruit on a Blackman, will be diappointed. It is said to be a cross between peach and plum, and is probably a thoroughbred "mule."

Col. MCFARLAND. Would not peaches budded on Blackman plum be longer lived? I have plum trees that are twenty-five years old.

President COOPER. Mr. Engle's experience thus far proves that peach budded on Blackman plum will not take yellows.

Col. MCFARLAND. Probably the tree is not so liable to disease and may live longer. The peach does not often live longer than fifteen years.

Mr. ENGLE. I have heard of peach trees fifty years old.

Mr. SATTERTHWAIT. It seems the older trees get the less liable they are to take yellows.

Mr. CULLEN. At what age do they usually take the disease?

Mr. SATTERTHWAIT. Generally two or three years after planting.

Col. McFarland moved that the usual hours for meeting, 9 A. M., 2 and 7:30 P. M. be agreed upon.

Adopted.

On motion adjourned.

EVENING SESSION.

Quite a number of members arrived on the evening trains, and, the meeting was not called to order until 7:45, after which President Cooper read his annual address.

To the Members and Friends of the State Horticultural Association of Pennsylvania:

Once more it becomes my duty to address you. Not from any aspirations of my own do I assume the responsible task, but from an established custom it seems to be expected that your chairman, no matter how incompetent he may be to prepare the manuscript, should have his annual address; and since you have again assigned the duty to me, I shall endeavor to fulfil the mission to the best of my ability, hoping to have your kind indulgence and assistance in presiding at this, the twenty-eighth anniversary since the organization of the association.

To say that we have made a corresponding progress with the other trades of life, in the now more than a quarter of a century since the formation of the little band that organized the Fruit Growers' Society, would be presumptious on my part; and yet, with all the horticultural science that has been disseminated, are we to-day any better able to successfully battle the enemies of fruit culture than we were twenty-five years ago? Are our orchards more productive than in days of yore? Can we devise the means to successfully grow a crop with insect enemies and climatic influences against us? Has the hybridization of fruits been any advantage except in the multiplication of varieties? Are our fruit-houses stocked with luscious, home-grown fruit, as when we were boys? Then it was no uncommon sight to see fine Smokehouse, Bellefleur and Fallawater apples in perfection long after the holidays. Where are they now? These were followed later with fine, crisp Winesap and Gray and Red Romanite from the hole in the garden, to the delight of the small boy and the health and pleasure of the older people. I do not wish to be understood that we have been retrograding, but wish to make the comparison with the present time. Some of you will doubtless say the sorts referred to have been supplanted by others of greater merit. Perhaps they have, but when we want them the worst they are not there. I do not wish to put a gloomy aspect on fruit growing. We have much to be grateful for; we are, notwithstanding the many enemies encountered, blessed with bountiful crops. Some may fail, but the almost endless variety of small, as well as the larger fruits, fill the supply to the gratification of every palate.

We meet this year in one of the oldest towns of the American republic, its history dating back to the foundation of the country. With its extensive iron and other manufacturing industries, its rich agricultural district and the seat of the Lehigh University, the highly intelligent community who have grown high in the art of cultivating fruits and flowers by artificial means. We have great cause to be thankful that our lot has not been "cast among thorns." Although I did not have the pleasure of being present at the meeting here in 1880, there

has been none but the highest praise of the very kind and cordial reception at that time. I. therefore, trust that our mission at this session will be a renewal of the friendly interchange of ideas and experiences, and that we may be able to give as well as receive the thought that may prove a mutual benefit.

Fruit culture in our climate is one of the most precarious industries. And yet our existence depends upon its products. The increase of insect enemies should not deter, but inspire us to greater vigilance. Climatic changes, over which we have no control, may sometimes discourage, but may also awaken the thought that enables us to avoid total failures. The health-giving properties of our fruits are essential to our organism. Especially in the temperate and torrid zones, more fruits, and less oily matter, would bring comfort to the body, strength to the mind and tone to the nerves. It is a mistaken idea that fruit should not be eaten at breakfast. There is nothing so well calculated to correct the acid secretions as a cooling subacid fruit, such as peaches, apples, &c.

We have cause of congratulation in the establishment of "A National Bureau of Pomology" by the government. It is to be hoped that much good may result, and scientific knowledge disseminated not attainable from any other course. Although the appropriation is a meager one, it is sufficient to show there is a disposition on the part of Congress and the officers of the government to assist in the horticultural as well as the agricultural interest of the country. Let us hope with the strong arm of the nation to assist, we may ere long be able to solve the troublesome problem of *peach yellows*. The distinguished pomologist, Mr. Van Deman, with his wide and varied experience in pomology, eminently qualifies him as the head of the bureau. The objects of the bureau, from the best I can learn, are the establishment and maintenance of experimental stations, if possible, in connection with agricultural colleges, the gathering of statistics, the investigation of foreign markets, the personal examination of new fruits, the establishment of a cabinet of models representing fruits as grown in different States and sections of the country. It is now to be hoped that our most experienced horticulturists and all others interested in pomology will assist and cöoperate with the bureau in establishing a line of experiments that will in the near future be a beacon for success to the fruit grower.

The thought has frequently occurred to me that we might have a *State Board of Horticulture*, or a *State Board of Agriculture and Horticulture*. This would of course necessitate the appointment of an additional or assistant secretary to the very efficient and courteous officer now filling the position in this State. The consolidation of the two branches of industry into and under one head could not conflict with either. Horticulture is but a higher and more advanced growth of agriculture, and the interest of both so identical that it would be impolitic to divide them. And since we are to have a National Bureau of Pomology, could we not have more efficient service, more intelligent and better conducted experiments, and better and more frequent reports through the State Board than by any other means? There is little doubt in my mind that this matter could be accomplished with but little difficulty, the Assembly being now in session, and in all probability there will be some legislation to enlarge the workings of the State Board at the present session. The interests of this Commonwealth, with its various soils and many advantages, locations in

altitude for successful horticulture, should be an incentive to our public-spirited members of the Legislature to foster the interest of pomology in our own State. We have thousands of acres of hillsides now growing wild in scrub timber that could be made to produce tons of luscious grapes, peaches, strawberries and other fruits to the gratification of a hungry populace, who hunt the markets for native, but are compelled to take that brought from other States.

New factors in horticulture are constantly making their appearance. We have new avenues of exchange, new plants, flowers and fruit, new diseases, insect enemies and surprises of climate. We find new adaptations for old things, and the old are sometimes resurrected as new. These everchanging conditions of horticulture admonishes all who would be live men or women to adopt every agency for the enlargement of our knowledge of the facts surrounding us and of the wider relations to which our interests extend. There is within our reach no single agency which does so much to bring into public view the results of individual research as the organized societies of the times. Horticulture in the larger definition covers a wide field. It has outgrown the restricted definition which confined it to the garden. The modern horticulturist has taken for his task *all* the sciences and arts which relate to the garden, orchard, vineyard and forest. It relates to all that embellishes the home, the farm, the park and the public highway, and to all the great interests therein. Hence it becomes our duty to embrace all the means within our grasp to enlighten the untiring and ever vigilant pomologist to achieve the best results for his laboring care and industry.

I am gratified to see another step in the advancement of horticultural interests, by enlisting the assistance and cöoperation of the finer elements of mankind in the good work. Our worthy secretary has prevailed upon our western friends (who have heretofore not favored our association with their presence except at long intervals,) to give us a lady essayist. I sincerely hope this is but the beginning of what in the future will encourage the ladies to aid and assist, both by their presence and encouragement, in the deliberation of various subjects under consideration. Their presence itself has a refining influence. What can man do of himself? Life would scarce be worth the living. It is for woman that we toil; it is she who shares our sorrows and our joys, and it is she who assists in making this world the paradise where there are no forbidden fruits. Therefore I most cordially extend the hand of companionship and welcome the being that ennobles and elevates the meetings of our association.

Of the fruits of the season past I shall have but little to say. The ambitious and vigilant chairman of the general fruit committee has so exhaustively gone over the ground, that it would be inadvisable for me to attempt to add anything of interest. We, as usual, have had failures and successes, disappointments and surprises—some sections blest with an abundance and to spare, while others sparse and imperfect. One of the most unaccountable features to me is the dividing line between the location of remunerative crops and the one of almost total failure. True, cultivation, fertility enter largely into our successes, but it does not always follow that he who tills best shall have the largest yield. It matters not how fertile the soil, when climatic influences are adverse. So much depends on atmospheric conditions, especially when the trees or plants are in bloom. That although all the other requisits are complete, total failures are some-

times the inevitable result. In small fruits, the greater part of the eastern section of our State had an exceptionally large crop. The strawberry, which is mainly dependent upon rain and sunshine at the proper time, so far outstripped itself in production the past season as to surprise the growers and excite exclamation of wonder and praise.

A feature attracting the attention of some of our most practical orchardists is the adoption of some other than the peach root as a preventive of the yellows. Some of our southern pomologists have recommended the Wild Goose plum. or others of the Chickasaw type, as the stock to be used. There is one of them doubtless has all the requisites as to growth, hardiness, etc., but seems to be sadly deficient in productiveness. I allude to the variety known as the "Blackman." I have been watching and nursing one on my own grounds for several years in anticipation of at least getting seed for stocks, but as yet it has never even come to full bloom, although every season full of bloom buds. If it can be grown from cuttings, as has been asserted, and the percentage of loss not too great, we yet may have in it the proper substitute. Although I do not have much faith in the enterprise, I shall try some cuttings under glass to see what they will do. I am glad to know that the experiment is attracting the attention of some of our most practical horticulturists, who have planted with a view to test the fallacy or success of the enterprise.

The prevalent practice of amateur orchardists in planting new and untried varieties that are only known to the originator and the unprincipled tree agent, whose only object is to palm off worthless goods at fabulous prices to the unsuspecting victim, is still the cry over our land. The fertile brain of the deceptive vendor is always on the alert to devise some method of deception, that he may more easily turn the tide of trade to his benefit, without giving a proper equivalent.

I cannot refrain from my admonition of a year ago, to discourage the practice of experimental planting of new and untried varieties of fruits (and particularly apples) to the exclusion of old and staple sorts. I fully realize the folly after twenty years of watchful care and waiting, that about nine-tenths of the new novelties are either of little value or entirely worthless. Had I, in my orchard of eighty-five trees, planted three-fourths of it in sorts of known excellence in my neighborhood, I would now be able to reap some reward for my labor and pains. But such has not been my lot. The handsome appearance and quality of northern and western grown fruit induced me, as it has many others, to plant the more largely of the newer kinds, never for a moment doubting that what did well elsewhere would not succeed here. If planters would at first observe or inquire what best suits his vicinity, giving the preference to native sorts of his own location, failures would be less prevalent. Varieties that succeed well in the valley are often of little value on the adjacent hillside, and *vice versa*, those that flourish and produce in a limestone region may fail entirely in a sandy shale. Hence I conclude that the only safe guide is to plant good, reliable, tested varieties that have a local reputation in your immediate section, and not too many sorts, for it is easier to sell ten barrels of one good kind than it is to sell as many different, and I assure the tree peddler will soon be compelled to seek a vocation in other fields of labor.

The subject of issuing a catalogue of fruits, has been discussed at several previous meetings, although no definite action has been taken. Such have been adopted by other State societies to the advantage and

benefit of their citizens. The formulation of a list suitable for all sections is an impossibility. But by districting the State, say an eastern and western, a northern and a southern and perhaps a central or middle district for the State College. With the merit of each variety voted upon by counties, would, in my judgment, by some criterion to which planters might refer for information. The usefulness of this association can undoubtedly be augmented by the unselfish adoption of such a list, accompanied by some general information of how and what to plant.

In Memoriam.—"Father time" during the last year seems to have laid a heavy hand on several of our most honored, most endeared and useful members Men who have spent active and useful lives in pomology. Men whose public spirited benevolence and genial dispositions were the admiration of all. Men of retiring manners whose companionship and hospitality were sought far and wide, for the field of knowledge they embraced. Men whose unselfish dispositions for the good of mankind, will leave living monuments to their praise. Men whose horticultural experiments have been examples for all to observe with profit. I do not deem it necessary to refer to each in his individual capacity as one of the most esteemed members has kindly relieved me of that duty.

The increasing desire for rural home and home adornment, is one of the pleasing features of modern horticulture. Fine lawns laid out in ever-curving walks, and grounds dotted with forest and other trees. Beds of well-trimmed shrubberry advantageously located to break the monotony of the scene, lend their beauty and fragrance to the happy surroundings. Borders and ribbon beds of semi-tropical plants attract the eye to the beautiful in nature's gifts, and charm the observer from the baser thought of life. Is it any wonder the progressive horticulturist's untiring zeal should seek such surroundings to rest his weary head and tired brain, when the fragrance of roses and the linden blend in harmony to distill the essence that feeds the soul.

In conclusion allow me to extend my most sincere thanks for your kind attention, trusting that the continuance of this meeting is but the rekindling of that social spirit of pleasure and profit that has and still prevades since the organization. It is my great desire that the good work go on, and that in our every day walks of life, we can look back to the meetings and the pleasant associations connected therewith, as among the brightest pages in our history.

Mr. THOMAS, treasurer, submitted the following report, which was accepted and referred to an auditing committee consisting of Messrs. Bartram, Smith and McFarland, who subsequently reported it correct and satisfactory.

ANNUAL STATEMENT OF THE TREASURER.

GEORGE B. THOMAS, *Treasurer, in account with the State Horticultural Association of Pennsylvania.*

1886.	*Dr.*		
	To cash on hand as per report, ...		$420 79
Jan. 20.	To cash for annual dues of members, . .	$154 00	
22.	To cash for life member, Edwin W. Thomas,	10 00	
29. / Oct. 13.	To cash for annual dues of members, . .	16 00	

Nov. 4.	To cash for annual dues, per E. B. Engle,	$14 00	
	To cash for postage on reports, per E. B. Engle,	4 28	
10.	To cash for annual dues,	1 00	
			$199 28
			$620 07

Cr.

1886.			
Jan. 20.	By cash paid Thomas J. Edge, librarian, for exchange on books from Detroit, Boston, Missouri and Kansas,	$4 00	
	By cash paid Cyrus T. Fox for freight on reports, postage, printing, stationery, &c.,	16 99	
21.	By cash paid E. B. Engle for printing, circulars, stationery, express, &c.,	33 63	
	By cash paid E. B. Engle as salary for 1885,	25 00	
	By cash paid Reuben Goodhart for services as janitor,	2 50	
29.	By cash paid F. S. Hickman for furnishing and printing 100 postal cards as notices to members for dues,	2 00	
Nov. 4.	By cash paid E. B. Engle for express, stationery, printing and stamps,	41 70	
			125 82
	By balance,		494 25
			$620 07
1887.			
Jan. 18.	To cash on hand in Farmers' National Bank of West Chester,		$494 25

Mr. H. C. SNAVELY, chairman committee on nominations, submitted the following report:

Your committee on nominations beg leave to report the following names for the ensuing year:

President—CALVIN COOPER, Bird-in-Hand.

Vice Presidents—JOSIAH HOOPES, West Chester; H. M. ENGLE, Marietta; E. SATTERTHWAIT, Jenkintown.

Recording Secretary—E. B. ENGLE, Waynesboro'.

Corresponding Secretary—W. P. BRINTON, Christiana.

Treasurer—J. HIBBERD BARTRAM, Milltown.

Librarian—THOMAS J. EDGE, Harrisburg.

Your committee would further state that they would have reported all the present officers for re-election but for the urgent request of the present treasurer, Mr. Thomas, to be excused from longer service as treasurer of the Society. We would recommend the adoption of the following:

Resolved, That the thanks of this Society are due and hereby tendered to George B. Thomas for his long and efficient services as treasurer of the same.

HENRY C. SNAVELY,
JOSEPH W. THOMAS,
THOMAS RAKESTRAW,
THOMAS B. MEEHAN,
A. S. SHIMER,
Committee.

The resolution was unanimously adopted.

On motion, report was accepted and committee discharged.

President COOPER. I had hoped I would be relieved from serving further as your president. I would be very much gratified and ask as a special favor that some one else be nominated.

Mr. ENGLE. I am sure the Society is not disposed to relieve Mr. Cooper, and I trust he will consent to serve. I move the secretary be authorized to cast the ballot of the members present.

The motion was adopted and the aforenamed officers were elected.

President COOPER. I will accept, hoping for your cordial coöperation and assistance.

Next in order is the report of general fruit committee, but in the absence of Chairman Fox we will proceed to other business.

Mr. SNAVELY. At the afternoon session the Hatch bill was under consideration, and was referred to a committee of three for further action. I hope the chairman is ready to report.

Mr. COMFORT. As chairman of said committee I am authorized to report. That if the government is inclined to spend some money for the benefit of experiments in agriculture and horticulture, the movement has our approval.

Col. MCFARLAND. I hope we will endorse the report of committee. It seems that this bill has the earnest support of some of our leading and best informed agriculturists and horticulturists, and I believe it will be productive of good. Every State in the Union will have facilities for gathering statistics in the same line and we cannot help but he benefited. I hope the secretary will be asked to correspond with our members of Congress in reference to the passage of the bill.

For the benefit of those who were not present at its first reading, the bill was again read by the secretary.

Mr. ENGLE. If Congress is willing to do this for the benefit of agriculture and horticulture, I dont see why we should not endorse it.

Judge STITZEL. Although this bill is not quite what we would like, it may be a stepping stone to something better, and I hope we will endorse it without a dissenting voice. I think we should also have made an abstract of our minutes on this subject and forward it to our members of Congress from Pennsylvania.

President COOPER. This bill seems to be the beginning of a good move, and while it may not be perfect, I think we should approve it.

Mr. MEECH. Our New Jersey Horticultural Society at its last meeting, gave this bill a hearty endorsement. Our agricultural experiment station is in charge of Rutger's College.

The following was offered by Col. McFarland and unanimously adopted.

Resolved, That the State Horticultural Association of Pennsylvania, in annual sessions assembled, cordially endorses House bill No. 2933, known as the "Hatch Experiment Station Bill," and earnestly requests the Senators and Representatives from Pennsylvania to vote for the passage of the same."

On motion the Secretary was directed to send a copy of the resolution to each Senator and Representative from Pennsylvania.

Mr. HOOPES. Some time ago the president of this society requested me to prepare a few lines in reference to deceased members. While I would have preferred that some other member had undertaken this duty, I have done the best I could, and beg to offer the following:

IN MEMORIAN.

Never, in the history of our association have we sustained so great a loss by death, as in the past year. The adage that "death loves a shining mark," has been dearly exemplified in our midst. No less than five of the originators of this society, all of whom joined in its first year, have passed away since last we met together. A feeling of sadness will unconsciously overspread our deliberations, as the memory of these old and tried associates continually rises up before us. Their places will indeed be difficult to fill. Long lives devoted to the study of nature, so eminently qualified them for the position of teachers, that their fellow-members in common with horticulturists everywhere, cannot but mourn the dispensation that has removed them to a more perfect state of existence.

It is a beautiful custom that places on record a grateful tribute to the memory of a life well spent; not alone for the mere purpose of eulogizing the character of a departed friend, but to accomplish the higher and more useful service of handing down to survivors, the beneficent example of a valued member of the human race. The lives of these friends with whom it has been our good fortune to associate in past years, and the recollection of whose good deeds we so fondly cherish, were so closely connected with the work in which we as a society are engaged, that their now vacant seats remind us of the necessity there exists for others to assume the responsibilities which they have laid down. Their work on earth is ended, and to the memory of their manifold good deeds, the lines of Whittier are especially appropriate:

> "Give fools their gold, and knaves their power,
> Let fortune's bubbles rise and fall,
> Who sows a seed, or grows a flower,
> Or trains a tree, is more than all."

Thomas M. Harvey and Samuel W. Noble, two exemplary members of the religious Society of Friends, were among our earliest associates. When the idea was conceived of establishing an association for the advancement of horticulture in Pennsylvania, they were among the foremost to assist in the work; and to their valued aid is largely due the usefulness of this society in its younger years. Plain and unassuming in their intercourse with others, they pursued the even tenor of their way, leaving as their brightest legacy, characters that will bear the strictest scrutiny in everything that makes a man honored and beloved. Always ready to lend a helping hand to others, and especially to the young, the influence of their example will have a salutary effect upon those whose good fortune it was to claim them as friends. Although simple and artless in their demeanor—almost to a fault—their life-work was none the less valuable. It was a striking coincidence that these two men, eminent in their own loved art, and closely connected by the strong bonds of friendship and congenial pursuits, should have ended their lives within the space of twenty-four hours of each other.

Another of the original founders of our society, Jacob B. Garber, has finished his work on earth since we last met together. In the earlier years of this association, our aged member was one of the most prominent in his endeavors to establish our infant organization upon a prosperous and useful basis.

Notwithstanding his modest demeanor even to reticence in our

councils, he was at all times willing and anxious to lend a helping hand to others with less opportunities for gathering knowledge than himself. He was emphatically a life-long student of horticulture, and after the infirmities of age had necessitated a close confinement to his home, he informed the writer, he was "always with his friends in spirit, if physicially incapacitated from meeting with them in their annual conventions." Experimenting with new fruits was a favorite source of enjoyment, as well as of great practical value to himself and friends. Of grapes, especially, his knowledge appeared to be endless, having practically tested every variety of consequence that had been offered to the public for the past half of a century. He was a fluent writer, and his frequent and always interesting letters to his correspondents were highly prized. In this particular he was especially gifted; and the depth of thought and wonderful store of knowledge so often manifested in this way to his numerous friends, will not soon be forgotten.

Apollos Walcott* Harrison, an ex-president and member of our society for the past quarter of a century, was one of the most useful and indefatigable of our associates. Rarely ever missing from our conventions, his readiness at all times to assist others with his rich fund of knowledge, rendered him invariably a welcome visitor. Kind, genial and eminently social in his disposition, he made hosts of friends where others would have failed. Few beyond the limit of his intimate associates knew that, although comparatively self-taught, he possessed a wealth of scholarly attainments seldom acquired; and yet withal, his modest demeanor and plain unobtrusive manner will long endear his memory, not only to our own fraternity, but to a large circle of friends everywhere.

Mr. Harrison had a keen perception of the beautiful in nature as well as in art; and very many of the exhibitions of the Pennsylvania Horticultural Society were indebted for their peculiar charm to this pleasing trait in the lamented secretary.

He was thoroughly conscientious and consistent in all the walks of life. Never recommending unto others what he did not honestly believe or practice himself; nor intrude his opinions unasked upon his fellowmen. It has been the privilege of the speaker to know him long and well, and with this intimate knowledge has arisen the assurance that his circle of friends has been benefited by his life and example. Of him it may be truly said:

> "None knew him but to love him,
> None named him but to praise."

Philip R. Freas, for many years a conspicuous horticultural writer and editor, was among the first to evince a deep interest in the affairs of our society. In the earlier reports of our conventions may be found his remarks on a variety of topics intimately connected with pomology. A defect in his hearing, as well as failing health, prevented his attendance during the latter years of his life, but his interest in our work remained unabated to the last. He entertained strong convictions of duty, and was unyielding in his hostility to deceptive and unprincipled men and measures.

The short terse articles from his pen on various subjects were always to the point, and were uninfluenced by fear or favor. Strong in his friendships to those whom he trusted and admired, but relentless in his censure and criticism of shams and pretentious characters. His

limited but carefully-tended garden was a never-failing source of pleasure to himself and friends, for here in a small way were his numerous experiments conducted for the benefit of the public as soon as he was convinced of their accuracy.

As a slight tribute to the memory of our late fellow-members, the following resolution is respectfully offered:

Resolved, That we deeply feel the loss of our beloved associates. Thomas M. Harvey, Samuel W. Noble, Jacob B. Garber, Apollos W. Harrison and Philip R. Freas, and desire to record our appreciation of their many virtues so beautifully displayed throughout their useful lives. The cause of horticulture had no warmer advocates, no more devoted adherents, nor more truthful exponents than these; and we desire to extend our sympathy to their respective families and friends in this our mutual bereavement.

We have experienced an additional sense of bereavement by the recent intelligence of the death of our illustrious honorary member, Marshall P. Wilder, of Dorchester, Mass.

In referring even thus briefly to his eminent life and services I sensibly feel my inability to perform the duty in an acceptable manner, He was one of the few men of our time of whom it may be truly said "that a nation mourns his loss." All over our broad expanse of country, as well as in foreign lands, wherever a fruit is known the name of this honored man is beloved and cherished.

Seldom has any one attained such eminence in any particular line of study, and perhaps none have ever left behind them a larger circle of friends than he. As president of the American Pomological Society, from its inception to the day of his death, he had in a manner become the head of American horticulture, and especially in the nomenclature of our fruits.

As a presiding officer he was remarkably dignified. courteous and impartial in all his rulings, invariably commanding the respect of his fellow-members. But in the home-life and in the society of congenial friends is where his many sterling social qualities were most conspicuous and where his loss will be the most keenly felt.

In commemoration of the services of our distinguished associate, the following resolution is respectfully submitted:

Resolved, That this society having learned with deep regret of the death of our valued honorary member, Marshall P. Wilder, of Dorchester, Mass., we desire to place on record as a slight tribute to his memory our appreciation of the great work he has performed. In this bereavement American horticulture has met with an almost irreparable loss, and pomology in particular has been deprived of a guide and teacher who will be difficult to replace. In his character were united attributes which made him a shining example to the young men of our land and a kind, genial, warm-hearted friend to those of more mature years.

As participants in the universal sorrow, we tender our sympathy to the family circle, who comprehended above all others his character and prized his worth.

REPORT OF COMMITTEE ON EXHIBITION.

Mr. Satterthwait. As chairman of said committee, I would state that nothing was done, and that we have prepared no written report. The Pennsylvania State Agricultural Society did not seem disposed

to offer any inducements for making a display of fruits, and no exhibit was made by our association.

Judge STITZEL. In our meetings heretofore it has been customary to discuss papers and reports as read, and, if in order, I will now refer to some points that have been suggested. Our president, in his annual address, referred to certain varieties of fruits as being best adapted to special localities. At the meeetings of the American Pomological Society the various fruits are marked with stars to designate their quality and value in different localities. I think that some such list should be arranged and presented at our next meeting. I would suggest that our secretary be requested to prepare such a list.

Mr. ENGLE. Before that is put as a motion I have a remark to make. Unless we divide the State into districts we can hardly arrive at any satisfactory conclusion. I would like to hear Mr. Van Deman's views.

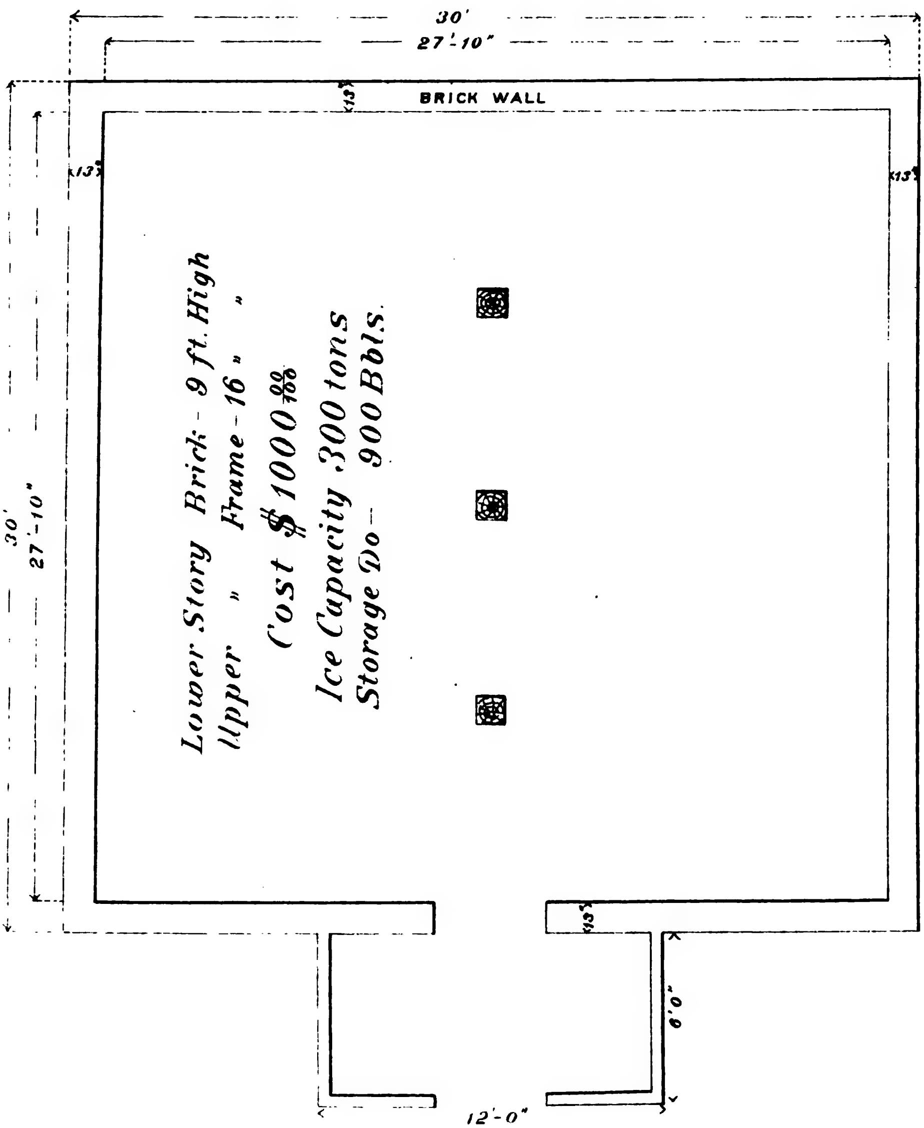
Mr. VAN DEMAN. I will be glad to offer a few suggestions on this point. The object in preparing such a list is to get some reliable information for the benefit of persons in the State who wish to plant. If the plan, which has just been suggested, of starring a list of fruits is attempted to be carried out you might devote a whole day to the work and not get half through. Many of your Pennsylvania horticulturists are not here, and a large portion of your State is practically unrepresented. The best method of preparing a fruit list that I have seen is that adopted by the Kansas Horticultural Society. The State is divided into three districts—northern, middle and southern. Probably in your State you would need but two, though that depends upon your soil and the range of your climate. Your secretary could prepare blank forms and send them to horticulturists or interested parties in every county, asking them for lists of fruits that do best in their respective localities. Each correspondent could name the best five varieties of summer and fall, and best ten varieties of winter apples, and so on, if desired, through the entire list of fruits. These reports could then be compiled by the secretary, and the result would be a fruit list that would be a reliable and valuable guide for every section of your State.

Mr. MEECH. We have a plan similar to this in New Jersey. We have a vice-president in every county or congressional district, who gets the views of his neighbors and sends them in a condensed form to the chairman of our general fruit committee, by whom they are compiled for general information and guidance. These reports are looked upon with great favor by our horticulturists.

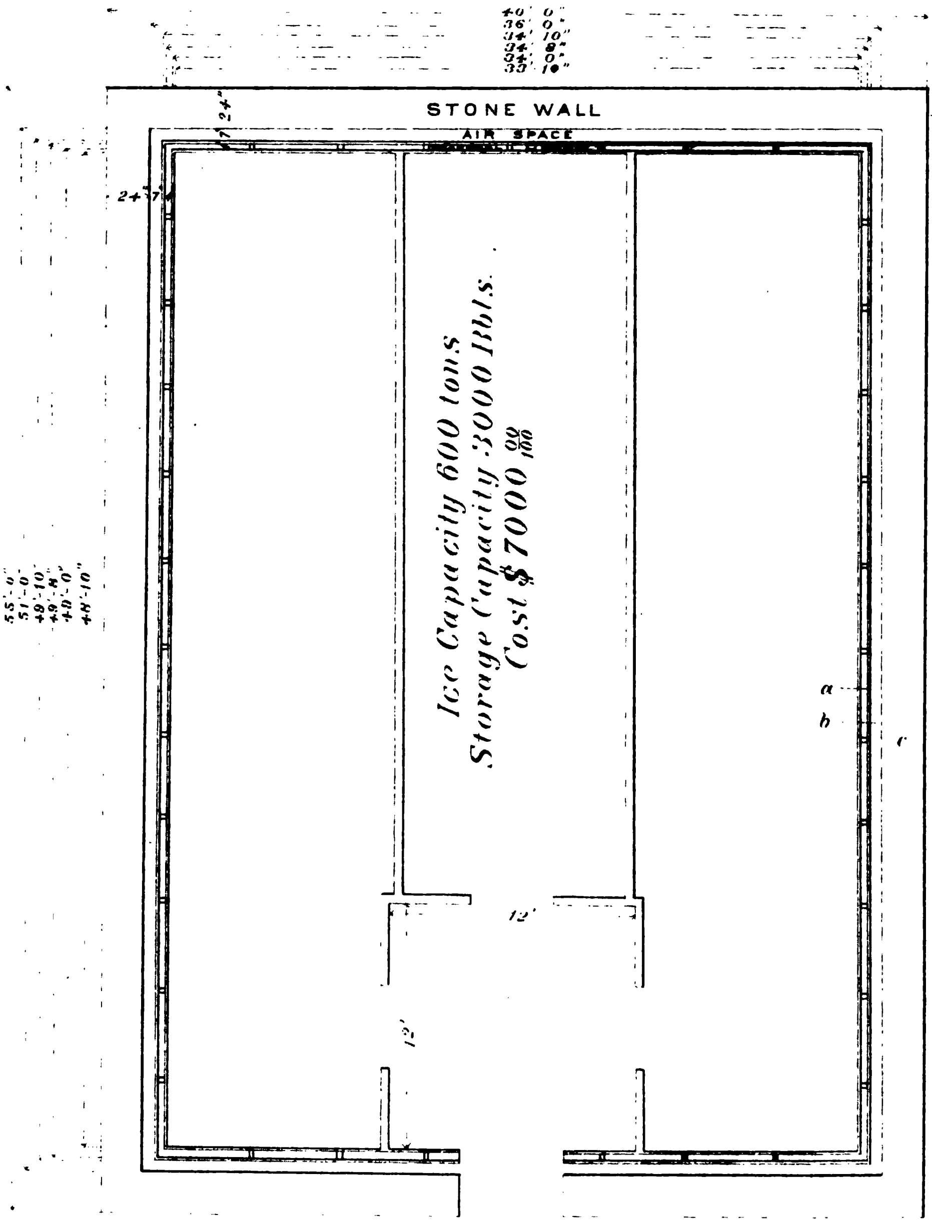
Mr. HOOPES. The great trouble hitherto has been to get reports from the different counties. At the first meeting of this society, a committee consisting of one member from county represented, was appointed to prepare a general fruit list for the State. John Rutter was chairman of said committee, and although circulars were sent out to every county the committee did not get any responses.

Judge STITZEL. This society has made considerable progress in this direction in recent years. We are generally reaching every section of the State, and in a few years at farthest, will have a correspondent at least in every county of our Commonwealth. I accept the suggestions offered by Mr. Van Deman and hope our secretary will be authorized to prepare the necessary blanks and gather statistics for a complete fruit list for the State.

Mr. SATTERTHWAIT. No subject that we can take up is more im-



GROUND PLAN OF A COLD STORAGE HOUSE OF 900 BBLS. CAPACITY.



GROUND PLAN OF DR. FUNK'S COLD STORAGE HOUSE.

CAPACITY, 3,000 BBLS.

portant than this, but judging from my experience in the past as chairman of our general fruit committee. such circulars would not receive much attention. If we adopt the plan of the "American Pomological Society," we have enough members here now to get the sentiment of the intelligent fruit growers of the State. A fruit list prepared in this way would be valuable as a güide and could be revised from year to year.

Mr. ENGLE. I have urged this matter time and again, and I hope to see it carried out in some practical shape. When possible, it would be best to get the views of several horticulturists or fruit growers in each county.

Mr. HOOPES read article second of the by-laws to show that same object was contemplated at the organization of the society.

The hour of adjourment having arrived the further consideration of the subject was postponed.

MORNING SESSION—THURSDAY.

Business was resumed at nine o'clock. President Cooper called the attention of the members to a handsomely bound volume of "the Horticultural Art Journal," published at Rochester, N. Y., and presented by the Editor, T. B. Jenkins.

On motion a vote of thanks was unanimously tendered for the work.

FUNGUS DISEASES OF THE GRAPE VINE AND THEIR REMEDIES.

The following paper was read by Prof. F. L. Scribner, Micologist of the Department of Agriculture, at Washington, D. C.:

Mr. President and Gentlemen of the State Horticultural Association of Pennsylvania: I beg leave to call your attention to the work and aims of the Mycological Section, recently established in the Department of Agriculture by Commissioner Coleman. The character and object of this work are clearly set forth in the Commissioner's report to the President. In this report he says:

"Early in my administration I found that the Department was in constant receipt of letters from agriculturists and fruit-growers in all parts of the country, earnestly asking for information on matters pertaining to the diseases of plants caused by fungi, and especially inquiring for remedies that would enable them to prevent or at least check the losses occasioned by the parasites.

"From results already obtained, and from other sources of information received during the administration of this branch of the Department, we may safely assume that the value of the corn and wheat annually destroyed in this country by diseases induced by fungi is not less than $200,000,000. The potato rot, so destructive in wet seasons, caused a loss in 1885, in the chief potato-growing States, of from ten to forty per cent. of the entire crop. The grape vine is particularly subject to the attacks of fungi. Scientists have described over two hundred species found upon this plant alone. Some of these, as

the mildew and black-rot, are particularly destructive, so much so that grape growing has ceased to be profitable in many localities once noted for their production of this fruit, and hundreds of acres of vineyards have been rooted out simply because of a lack of information respecting the nature and habits of these parasites and the means to be employed in preventing their ravages. The rust of the cotton plant is another fungous disease that causes incalculable losses to planters of the cotton-growing States. The orange interests in Florida are seriously threatened by the fungi that attack this tree, over one hundred species of which have been figured and described by European mycologists. The apple tree has its peculiar and destructive parasites, and so have the pear, the peach, the plum, the quince; and so also have the small fruits, as the raspberry, blackberry, currant and strawberry; nor are our garden vegetables, nor the plants we cultivate for ornament or shade, more exempt than others from the ravages of these diseases."

Fully appreciating the value and importance of information on this subject, and understanding its intimate connection with the interests of horticulture and general agriculture, one of the first matters, to which I gave attention upon assuming the duties of Commissioner was this question of the fungus diseases of plants. The life history of these disease-producing pests has, for the greater part, yet to be traced. Careful and long-continued observations, both in the field and laboratory, will be required to accomplish this, but such work is necessary if we wish to make intelligent application of remedies to combat these evils. We have to learn how these fungi are distributed, how they come upon or enter the plants they infest, what phases of development they pass through—phases often more complicated than the transformation of insects, and far more difficult to trace—and, finally, how they maintain their existence during the season of winter. This work has been accomplished in only a very few cases.

A consideration of the above facts will satisfy the most casual observer that the field for labor is a large one and the difficulties connected with the work of investigation necessarily render it slow of results, but the great practical value of these results when attained, will I am sure, more than warrant the labor spent upon them. If, for example, through these investigations, we learn how to effectually prevent the leaf rust of the cotton plant, or the yellows of the peach, the value of such a result would be so much out of proportion to the aggregate of the entire annual appropriation made to the Department, that the latter would sink into insignificance.

During the early part of the present season circulars were distributed to all parts of the country, for the purpose of gaining a more exact knowledge of the range and extent of injury occasioned by the fungus diseases of the grape, and material was collected and plates of illustrations prepared for a special report on this interesting and important subject.

This report has just been issued, and I take pleasure in laying it before the members of this society. In this report much space is given to the subject of remedies for the diseases enumerated, and it is believed that the chapters contained in appendix C, in which a detailed account is given of the experience of French and Italian vineyardists in combating the downy mildew, will be found interesting and valuable to American grape growers.

Not included in this report are the experiments of Messrs. Millardet and David during the past season (1886) at Dauzac and Beaucaillou. These experiments are especially instructive. Eighteen remedial mixtures, dry and fluid, were tried very carefully, with the necessary control experiments. The experimental fields covered, in all, about five acres. The results obtained are given in the table before you. It will be seen that the most completely productive substances were: (1) The copper mixture of Gironde; (2) Davids' powder; (3) Podechard's powder; (4) a mixture of sulphate of copper and plaster; (5) cupric steatite (a bluish-white, unctious powder, composed of steatite and sulphate of copper); and (6) sulphatine (a secret mixture of sulphur, lime, sulphate of copper and plaster).

The formula of the copper mixture of Gironde, with instructions for its use, are given in my report, pp. 15 and 16.

DAVID'S POWDER is thus prepared: Slake 66 pounds of lime in the least possible amount of water, and dissolve 17½ pounds of sulphate of copper in the smallest quantity of water necessary to effect its solution. Mix the latter with the lime when it is completely cooled. Let the compound dry in the sun, then crush and sift it, when it is ready for use.

PODECHARD'S POWDER: Preparation, &c., fully described on p. 81 of my report.

PLASTER AND SULPHATE OF COPPER: Is composed of 66 pounds of plaster and 17 pounds of sulphate of copper. The copper salt is dissolved in the least possible amount of water and then poured upon the plaster. Mix thoroughly, dry in the sun, crush and sift.

AUDOYNAND PROCESS (*Eau celests*): A liquid remedy, strongly recommended by some, is prepared as follows: In a stoneware or glass vessel a gallon of warm water is poured upon two pounds of sulphate of copper, which are stirred with a wooden or glass rod, to hasten solution. When cooled, a pint and a half of commercial ammonia is added. Dilute to 44 gallons, and apply with any suitable spraying device.

The use of lime and lime with sulphate of copper, for mildew, gave such excellent results in European vineyards in 1885, that the commissioner deemed these remedies worthy of extended trial in this country, and for this purpose distributed last May, a circular giving their composition, and earnestly requesting that one or more of them be tried and the results obtained reported to the Department. Three thousand of these circulars were distributed, and there is reason to believe that many made a trial of some of the remedies proposed, but I regret to state that few responded to the request that the results of the trials be reported. It is hoped that another season there will be a more hearty coöperation between the vineyardists of the country and the Department in this work.

I will take the liberty to read the report made by one correspondent under date of December 28, which is as follows:

On June 13th I sprinkled lime water, as directed in No. 2, of instructions, upon one acre of Catawbas, about one thousand vines. There was a heavy rain on the 24th, washing the lime from the foliage. The weather became quite hot, so on the 28th I again sprinkled the vines. No perceptible advantage over vines alongside not treated. Also upon four hundred vines, both upon foliage and on ground under vineyard rows, I sprinkled air-slacked lime June 7, 14, 22, July 5, 23

and August 9, with but very slight beneficial results, if any. I imagined the wood ripened somewhat better than upon untreated vines.

Sulphate of copper and lime was applied as directed in remedy No. 3, with results that convince one that with the proper application this remedy will prove more beneficial than any thing yet known here for mildew and black-rot. Fourteen vines were selected, eight together, the balance in different parts of vineyard—twelve Catawbas and two Noah.

The first application was made June 14, spattering the foliage very thoroughly. There was considerable rain on the 20th and 21st inst., not entirely washing the leaves clean. On the 22d made a second application. First mildew was observed on the 22d of July. On the 23d I again put on the sulphate of copper and lime mixture, although the previous application was yet quite perceptible upon the foliage. Of the vines so treated, not one was affected by either mildew or rot; the foliage holding its natural color long after that on other vines had become brown and seared; the wood and grapes ripened thoroughly. A Noah vine, upon which, for several years the berries had rotted more or less, and dropped from the cluster about the time of ripening, bore this season over forty pounds of grapes of good quality.

The coming season I will give this remedy a more thorough trial, feeling satisfied that it will prove effectual if applied in time. My impression is that two applications would be ample, the first soon after bloom or first indications of mildew, the second about the middle to last of July.

I also treated sixty Catawbas with a preparation made as follows: Dissolve one pound of sulphate of copper in two gallons of water; in another vessel, slack four pounds of lime in the same quantity of water, then mix these together thoroughly. The advantage was the preservation of the foliage in a healthy condition in a marked degree over vines untreated.

Bush & Son & Meissner, of Missouri, state that "we have tried all the remedies recommended in your circular, and find that designated as No. 3, to be the best. We are continuing to apply this mixture of lime with dissolved sulphate of copper (not too strong,) with confidence in its good results."

Another correspondent states that he has used Podechard's powder (No. 4) with marked benefit.

This report on the fungus diseases of the grape vine is the first fruits of the mycological section. In the next annual report of the department will be given an abstract of that portion of this report relating directly to the vine diseases with additional remarks on remedies. There will also be chapters on the potato rot, orange leaf scab, celery leaf blight, grass fungi, pear blight, etc.

Material is now being collected for an extended report on potato rot and also for reports on apple scab, strawberry rust, raspberry cane rust and several other plant diseases. I need not speak here of the importance of the work; none can appreciate that more fully than yourselves. I only desire to add that the establishment of this branch in the department with the view of promoting the interests of horticulture is directly due to the efforts of the present commissioner. He invites your coöperation and it is hoped that all will unite in lending their aid to the work.

On motion, a vote of thanks was tendered Professor Scribner for his able and instructive essay.

Professor SCRIBNER. I might state in addition that Mr. High, of Ohio, reports that vines treated in this way had neither mildew nor rot.

Colonel McFARLAND. When should these preparations be applied?

Professor SCRIBNER. These remedies are preventive and should be applied before the fungus develops. When it has once obtained a foot-hold it is likely to stay, but its spread can be checked. The spores germinate readily in water or moisture and develop in a few hours. If we could shelter our vines from moisture we would have no trouble with mildew. This is not possible, so we must use some application as a preventive. It is also a good plan to destroy the leaves by burning. They should not be used for compost or fed to stock as the spores will pass through the digestive organs without being destroyed. Black rot confines itself to the berries and produces several kinds of spores, developing usually in May or June. Powdery mildew has a different habit, as it grows on the surface of the leaves and berries and is more easily prevented by applications of sulphur. Where the ground temperature ranges from one hundred degrees upward sulphur will be effective. At seventy-five degrees it will do little good and at sixty degrees it is of no account.

Mr. ENGLE. With us the "thrip" or "leaf hopper" is one of the worst enemies we have to contend with, and if these remedies would destroy them they would be of two-fold value.

Mr. BRINTON. Are there not other kinds of mildew?

Professor SCRIBNER. These are the two varieties of mildew that attack the grape vine. There are no others that are of much account.

The following

REPORT OF COMMITTEE ON ORCHARDING

was then read by the chairman, Colonel George F. McFarland, of Harrisburg.

Admonished of the necessity of brevity, your Committee on Orcharding, leaving to your excellent General Fruit Committee a review of the fruit crops of the past year, and passing by several interesting inquiries, propose to address itself directly to the most practically important question to all, viz:

Can orcharding be made a financial success in Pennsylvania? And, if so, what shall we do to secure that success. This has always been an important inquiry to Pennsylvanians, but its importance is largely increased in recent years. Grain is now raised on the rich prairies of the West and transported through our State to the sea-board cities at lower prices than Pennsylvania farmers can produce it with profit on land harder to work and costing so much for fertilizers. The rejuvenated South is capturing the profits that used to be made by the wide-awake market gardeners on early vegetables and small fruits. The West has been regulating the price of cattle and cured meats by the cost of producing them on prairie grass and cheap grain with ruinously cheap through freights. It is now going further and supplying ready dressed fresh meats, cheapened by the machinery that organized capital can command. Thus are the sources of profitable employment by our farmers being lessened on all sides. It is, therefore, specially important to inquire what branches of industry can be made to pay in our State, and our farmers should be willing to promptly take hold of any new source of profitable industry.

After very thoroughly studying the whole question and examining the facts much more fully than can be explained within the compass of a short report, your committee claim with great positiveness that "orcharding can be made financially successful in Pennsylvania," for the following among many other reasons:

1. The broken, rolling character of the surface of the State favors fruit culture. Every township and almost every farm has its well-drained slopes, with suitable subsoil and exposure for growing some variety of fruit with profit.

2. The location of the State in the sisterhood of States favors it. Lying between forty and forty-four degrees of north latitude, and protected from the blizzards of the West by mountain ranges and hills, extremes of climate and storms are not as great.

3. The experience of skillful fruit growers proves it. Very little attention has been paid to skillful fruit culture in Pennsylvania as compared with other more successful States. But perhaps every county has its successful fruit raisers. These are men who have put to the raising of some one or more kinds of fruit the same skill and means that bring success in other avocations of life. The writer could fill page after page with names and facts to prove this if it was thought necessary. Perhaps every one who hears this can recall successes in raising profitably small fruits, grapes, peaches, pears, apples, plums, or quinces, while some of our veterans have been successful with all. These successes have been achieved in all parts of the State, on all kinds of soil and with every exposure. Indeed, so varied have been these conditions that every locality, soil and exposure has its special advocates, showing that skillful culture will secure success under widely different conditions.

Many other reasons might be advanced but must be omitted for want of space. We fully believe there is nothing in locality, soil or climate that prevents Pennsylvania from becoming one of the most successful fruit growing States in the Union.

But, if what is here claimed is correct, why, we are asked, "does fruit culture fail to be financially successful in our State?" We deny that it does fail. We claim that those engaged in fruit culture in Pennsylvania meet with as full a measure of financial success as the same means, attention and skill would have secured by any other use of the same amount of land. Success and failure are the results of the same inexorable laws in every avocation in life; persistent industry and skill in the use of the necessary means bring success. It is because these are so rarely applied to fruit growing that it does not pay. In fact, fruit growing as a distinct branch of business for profit, has as yet, scarcely a foothold in Pennsylvania. Most farms and residences have trees and vines planted for home use, which are allowed to die or overcome difficulties, and do well or ill, as they may, with the little or no attention given them; and then failure or success proves nothing. The few who have gone into it as a business have been pioneers who have had to learn by expersence, and pay, sometimes, very dearly for that experience. Those who continue until they acquire the same degree of knowledge in this business that is necessary to secure success in other branches of business, and apply the same business, principles, are sure to succeed. The others are certain to fail.

"What then shall we do to secure financial success in fruit raising in Pennsylvania?"

We answer, make it a business, and apply to it the same attention, skill and means as successful business men do to other branches of business. With these success is sure to follow; without no one has a right to expect success.

To particularize we say:

1. Unless you possess the necessary knowledge and experience, employ skilled labor as men do in mechanical and mercantile enterprises. This is as yet very scarce, and the sooner more attention is given to securing means of instruction for young men desiring to follow this business as a profession, the better. Why should not this association move in the matter?

2. Decide what kind of fruit will best suit your locality, ground, means and skill.

3. Select a well drained slope, not too much exposed and in a fair state of cultivation. This and after treatment are more important than the kind of soil. Dig large and deep holes, fill on the top soil first and plant a little deeper than the tree stood on the nursery.

4. If for profit, select a few varieties of healthy fresh trees direct from the nursery, known to be hardy, productive and salable. Except for family use, ten acres of one variety is more profitable than of any other number of varieties. Fifteen acres of Baldwins made the Miller Brothers, of New York rich.

5. Cultivate as you would your potato or corn crop, examine your trees three times a season for the borer and other enemies, wash them twice with soap suds or other substitute.

6. Pick and handle fruit carefully and grade it carefully before marketing. More money will be gotten for the fine fruit if the cullings are thrown away, than if all is sold together.

7. If fruit is plenty, keep yours till the glut is over. The greatest sources of failure to make fruit culture pay is in handling, grading, preserving and marketing the fruit. Half a crop well handled and sold when the market wants it, will pay well; while a full crop rushed into market in the usual way when it is overstocked, will leave no profit.

8. Fruit caves, cellars or houses of some sort, the more perfect the better, are absolutely necessary to success, and farmers and fruit growers must combine to secure them. Egg packers and butter packers and fresh meat dealers understand this. They secure refrigerator cars for shipping also, and they coin money in simply handling and marketing these products, while the producers who have not these conveniences, must just take what they are offered. Without means of preserving and skill in handling fruits, the grower is subject to the same loss.

Your committee see no reason for discouragement. Fruit grown in Pennsylvania is not now a profitable business we admit, but it can and should be made so. The nearness of good markets fully makes up for any advantages other States may have over us. To follow the few brief suggestions here given, with the pluck, intelligence and skill that Pennsylvanians bring to other business enterprises will bring success and place our State in the van of successful fruit producing States, where it by rights ought now to be.

Respectfully submitted. GEORGE F. MCFARLAND,
Chairman.

President COOPER. This is a very able report and is now open for discussion.

Mr. SATTERTHWAIT. The report is very complete and I don't think needs any discussion.

Mr. ENGLE. If the horticulturists of this State could realize the amount of fruit we import I think much more would be planted.

Col. MCFARLAND. I have watched this matter closely in Harrisburg, and know several dealers who import thousands of barrels of apples annually from New York. It is clearly our own fault. We don't raise wheat and fail to garner it, but we do raise apples and fail to properly utilize them.

Mr. MOON. The report of Orcharding Committee is very complete, especially the part referring to the keeping of apples. I know parties who bought apples last fall at forty cents per bushel and who could have doubled their money before Christmas.

Mr. COMFORT. Fruit in Bucks county was a total failure last fall. This is why party referred to went abroad to buy apples.

Col. MCFARLAND. We plant too many varieties. If we would plant one hundred trees of a kind we would do better. It does not pay to gather a few here and there, and fruit packers will not buy them. I am ashamed to say that I have over five hundred trees and I don't know how many varieties.

Mr. LONGSDORF. The paper just read is a very important one. We have had an enormous apple crop in Pennsylvania the past year, especially in the central and eastern portions, but what have we to show for it now? I don't know of an instance where the grower has profited by his enormous crop. It has been truly said we have no commercial orchards and we grow too many varieties. Many of our orchards have but one or two varieties that are desirable for shipping, and some have not enough good winter apples to justify a merchant in barreling and shipping them. Excepting the York Imperial, most of the fruit was either allowed to waste upon the ground or made into cider and apple-jack. We can succeed if we go into the business in the proper way. In some sections people are awakening to the proper method and are making it a success. As to quality, I believe Pennsylvania can produce as good fruit as is grown anywhere.

Mr. SATTERTHWAIT. The reason apples did not pay in our locality was owing to the drouth. We had no rain for two months, causing the fruit to drop prematurely, and we lost three-fourths of it in that way. What we secured has kept all right.

REPORT OF COMMITTEE ON FRUIT HOUSES.

Judge STITZEL. As chairman of this committee I am sorry to say I have not had time to prepare a written report.

There is no longer any doubt as to the success of refrigerator-houses if properly constructed and managed. There are several in operation in the city of Reading, and they are proving profitable both to the owners and users.

At our last annual meeting a committee was appointed to visit some of the Reading fruit houses and submit a report of their observations. I have also visited a number during the interum, and have found a great difference in style and methods of construction. Have found, however, that small houses are not generally a success. Have found them costing from $300 to $10,000. I have drawings of two, one cost-

ing $1,000, the other about $7,000, the latter being one of the most complete I ever saw and having a capacity of three thousand barrels. Both of these houses keep fruit very nicely.

In the construction of fruit houses an important point is to build sufficiently strong; some have overlooked this, and have since been obliged to put in additional support. I have had drawings, or plans, made of the two houses referred to. The large drawing represents the house already referred to as costing $7,000 and having a storage capacity of three thousand barrels. This was built by Dr. J. H. Funk, of Boyertown, Pa. In this building the outside dimensions are forty by fifty-five feet, the outer wall being two feet thick and laid in cement. Next to this is an air-space of seven inches, and inside of this a charcoal lining of four inches. The storage-room is divided into six apartments, which are entered from a vestibule, through which entrance is made from the outside. These doors are always kept carefully closed, so as to prevent a change of air. Height of lower story eight feet; height of building to square, twenty feet; which allows for a body of ice twelve feet thick, about six hundred tons. There are no windows except on front of building. The ceiling, or floor, upon which the ice rests overhead, is simply laid with joists about ten inches apart, permitting the cold air to descend easily. Spouting is arranged between the joists to carry off all drippings from the melting ice. There is no ventilation of the storage-room except what is admitted through entrance doors. The ice-chamber has two large ventilators in the roof. This building has been in operation one year, and has proven very satisfactory. The owner has excellent facilities for storing his ice cheaply, having a dam adjoining the building and an engine capable of elevating a ton of ice per minute. I think a house like this could be built for less than $7,000. The smaller building to which I have referred is thirty feet square; lower story, single brick wall thirteen inches thick and nine feet high; upper story frame. Ice chamber sixteen feet high, with a capacity of three hundred tons. Storage capacity, nine hundred barrels. The original cost of this structure was about $1,000, but repairs and additional supports cost $1,000 to $1,200 more. The ice is usually covered with corn fodder, or some similar substance, for protection. This house is used chiefly for storing butter and eggs.

Mr. D. E. LONGSDORF. In Mechanicsburg, Pa., a similar house has been in use several years and has proven a success, though the ice chamber is not large enough to hold a supply for the entire summer. Capacity about three hundred tons of ice, which usually runs out in September. The dimensions of the building are thirty-five by eighty feet, with a storage capacity of three thousand barrels. Walls are brick, fourteen inches in thickness. Inside of this an air space of four inches, then a charcoal lining of six inches. Storage chamber nine feet high and is usually kept at a temperature of thirty-five to thirty-six degrees. In this building apples have been kept from the previous year until September. Strawberries have been kept a month.

Mr. VAN DEMAN. From observations made and from what I have heard from others, I do not think it necessary to have dry air, if the temperature is low enough. I have heard of instances where drippings from the ice have run through crates of fruit that kept nicely. If the temperature is kept below forty, I am convinced that dry air is not necessary. I know of a case in Atchison, Kansas, where a beer

vault, in which there was a spring of water, was filled with apples that kept in fine condition.

Mr. ENGLE. There is one principle in keeping ice that should not be overlooked, and that is sufficient ventilation. When I built my first icehouse I made the ceiling tight and covered it with saw-dust, and the result was the ice wasted rapidly from the surface. After tearing out the ceiling and putting a ventilator in the roof it kept well. Probably some of the builders of refrigerator houses have disregarded this feature and are smothering their ice for want of ventilation. Another important matter in keeping ice from wasting is to fill up promptly with saw-dust or shavings any openings that are caused by melting. These admit currents of air that melt the ice rapidly.

Mr. LONGSDORF. The house in Mechanicsburg to which I referred has a ceiling over the ice and no ventilation. The height of the ice chamber has been increased three feet, which will allow the storing of sufficient quantity to last the entire season. It is used chiefly for storing eggs, and moisture is objectionable.

Mr. VAN DEMAN. I referred to apples, pears and grapes as not being injured by moisture in low temperature. No fungus will grow in such conditions.

Judge STITZEL. Mr. Longsdorf is likely mistaken in asserting that the ice melts from below. If the temperature is kept at about thirty-six it will not melt.

Mr. ENGLE. I think if he will tear out the ceiling and put in a ventilator, twelve feet of ice will be ample for the season.

REPORT OF GENERAL FRUIT COMMITTEE.

The following report was read by Mr. Fox:

To the Officers and Members of the State Horticultural Association of of Pennsylvania:

GENTLEMEN: The undersigned, in behalf the General Fruit Committee, would respectfully report that since the last annual meeting of the State Horticultural Association, held in the city of Reading, there has been a considerable increase in the committee, until now nearly every county in the State has its member, the few counties unrepresented being in the mountainous sections, where but little attention is devoted to the general objects of this association. A circular was sent out last month to every member of the committee, as well as to prominent pomologists and horticulturists all over the State, and of the two hundred and fifty such circulars mailed, answers were received to more than one-half, although it is to be regretted that some came at such a late day as to be of very little service. In accordance with a resolution adopted at the last meeting of the association, blanks were also prepared and distributed, requesting statistics in regard to "the quantity and quality of all kinds of fruit and berries cultivated in the State." Not one correspondent in ten, however, attempted to furnish any figures whatever as to quantity, in accordance with the purport of the resolution. The general opinion seemed to be that it would be impossible to make any accurate estimate, no record being usually kept of what is produced upon the farm in the line of fruit and vegetables and converted into cash. Mere guess work is not desirable, and it would be idle, therefore, to produce here the meagre information that has been furnished. Accordingly, no such attempt

will be made, but in recognition of the importance of arriving at some reliable data in that respect by machinery more certain than that which this association with its limited resources can command, your chairman would recommend that in the taking of the next census of the United States more particular attention be paid to the compilation of information in reference to the products of the orchard, vineyard and garden. This is a matter which should be brought to the notice of Congress by the Commissioner of Agriculture. The following brief summary is herewith presented in regard to each department concerning which information was solicited:

Apples—The crop of this fruit throughout the State may be designated as having been an average one. The dry weather of August and September caused the fruit to fall early, and undoubtedly impaired its keeping qualities. From all sections there is a universal complaint that the apple crop has kept poorly. The winter varieties ripened prematurely, but the remnant saved at the usual picking time was of fair quality. Apples were again, as usual, very badly damaged by the codling moth.

Pears—There was a large crop of pears, the yield in some sections having been immense. A few varieties, notably the Bartlett, suffered from overbearing, the fruit not having attained full perfection. The Beurre d' Anjou, Duchess, Keifer and Le Conte deserve special mention for extraordinary yield and perfection of fruit. A few varieties suffered from mildew, caused by excessive wet weather in mid-summer, but there was very little fire blight, and less complaint in regard to diseases than usual.

Peaches—There was a fair crop of peaches, especially on new soil. Some correspondents reported their trees to have been overloaded, and consequently the fruit did not come to its usual perfection. Late varieties suffered severely from the drought, dropping prematurely and not arriving at full size. The "yellows" continues to be the one great trouble with the peach, and the danger of its total destruction in Pennsylvania from this cause seems imminent.

Plums—Some correspondents reported an enormous yield of plums, wholly exempt from insects and disease. There were numerous complaints, however, in regard to the rot, especially as to the Lombard, which seemed to suffer more than other varieties. The varieties most commended are the Richland and the Wild Goose. The latter regarded as unusual hardy, was not exempt from the rot last year.

Quinces—More attention is being paid to the quince crop, and last year's results were quite satisfactory. The Champion is looming up, and bids fair to soon glut the markets.

Cherries—The cherry crop was only medium, but quality good. The Early Richmond was a little short in yield, but gave generally the best results. Most sweet varieties rotted badly.

Grapes—The vines set a fair crop, but the hot dry weather caused them to drop badly, and necessitating the speedy marketing of the crop. Very few reports were received in regard to new varieties.

Small Fruits—All kinds of small fruits did exceedingly well. Strawberries yielded enormously, and the quality was fine. Prices, however, were below the average, and so many seemed to have engaged in the business of raising strawberries, raspberries and blackberries for market that it is no longer a question of profit. This, however, should not deter every one who has a farm or garden from growing an abundance of small fruits for home use.

Vegetables—The past season was favorable for vegetables, with the exception of celery, turnips and some other late root crops, which were very materially affected by drought.

Shrubbery, Plants and Flowers—A growing taste for the adornment of grounds is reported. All those material objects which give us pleasure in the single contemplation of their outward qualities belong, more or less, to the realm of the beautiful. It is, therefore, exceedingly gratifying to learn that the horticulturist is giving more attention to the æsthetics of his calling. Rural ornamentation, neatness and taste in architecture, and display of flowers and shrubbery will make home inviting, and keep the sons and daughters from longing to escape from the comparative dullness of the country to the giddy whirl and dissipation of the city.

New Things in Horticulture—As to new things either originated or tested during the past year only meagre reports have been received. E. P. Swift, of Allegheny county, speaks very favorably of a new cherry, "McGibbony's Bigarreau," which he considers not surpassed by any variety now in cultivation. He also thinks well of a new grape, "Woodcock's Seedling," which he received from Mr. William Woodcock, of Fulton, N. Y. The new willow, *Salix cordata*, introduced from Nebraska, does well as a shade and ornamental tree. In grapes the "Empire State" is pronounced as one of the most promising varieties for general cultivation. The "Niagara" is not old enough to report results, although it will probably be the great market grape of the future. It has not shown entire freedom from disease. "Vergennes" may be classed among the best hardy kinds. Casper Hiller, of Conestoga, Lancaster county, makes favorable mention of the "Lancaster," a new sweet cherry, which on the original tree last season was in ripe condition for twenty days. The same gentleman reports that the "May King" strawberry proved extra good on his premises, and the "Parry" and "Jewell" are promising varieties, but have not been fully tested. Other members, who have given their experience in regard to new varieties, are satisfied with what they have already accomplished, but do not feel warranted in giving the same their entire endorsement until they feel better qualified to do so, especially as in regard to all new things several seasons are necessary to test their merits, and it would be unwise and misleading to recommend a variety for general cultivation until ample opportunity has been afforded of ascertaining its value under various circumstances.

In conclusion, your chairman would leave to the committees on Orchards, on Fruit List for Pennsylvania, on Fruit Houses, on Peach Yellows and other special topics, the discussion of such matters as they in their wisdom may see fit to bring before you, and which do not properly come under the consideration of the General Fruit Committee.

Respectfully submitted.

CYRUS T. FOX.
Chairman General Fruit Committee.

READING, PA., *January 19th, 1887.*

Mr. SATTERTHWAIT. As to a fruit list for the State, it may be well to say for the benefit of Mr. Fox, that this subject was discussed at last evenings session. Some suggested that a vote be taken by the members present; others thought the data should be gathered through the

general fruit committee, while some were in favor of having the secretary prepare the necessary blanks and solicit the desired information by mailing them to horticulturists and fruit growers in every section of the State.

Mr. FOX. Several attempts have been made to prepare a fruit list for the State, and thus far it has been almost impossible. It is necessary in the first place to divide the State into sections. Then we should endeavor to get the views of several leading horticulturists or fruit growers in every county, and have them report what varieties do best in their respective localities. Probably the most complete statistics could be gathered by the United States census takers, and our government could well afford a volume to the publication of such information. An effort to prepare a brief fruit list has been made during the past two years through the general fruit committee, and the result is being published in our report for 1886.

Mr. MOON. The object is a good one but before taking such an important step we should inquire how we will be able to obtain reliable and satisfactory reports from the various sections of the State. Comparatively few counties are represented in our society's meetings, and to vote upon a list here would require considerable time and then represent but a portion of the State.

The PRESIDENT. Judge Stitzel offered a suggestion last evening that was left over until to-day. I think we had better act on that.

Colonel McFARLAND. I have prepared a resolution covering the views of Judge Stitzel and myself, which, if there be no objection, I will read:

Resolved, That the secretary prepare blanks and send them to growers throughout the State, asking the varieties of fruit of each kind for five summer, five fall and ten winter varieties; the secretary to compile these reports and report them and the lists to the next meeting, when votes shall also be taken on these lists by counties by the members of the asssociation.

Judge STITZEL. I think it would be attempting too much to take the entire list of fruits in one year. We might solicit information on apples, peaches and pears this year and other fruits next.

Mr. ENGLE. Would we not do better by first districting the State, and leaving this question of a fruit list until our next meeting? If not out of order, I am in favor of dropping the whole matter for the present.

Colonel McFARLAND. I trust we will not delay this matter a whole year by postponement. We can have the secretary distribute the blanks and compile the reports received, and the voting on them will require but little time. I hope the resolution will be adopted.

A vote having been taken, the resolution was adopted.

REPORT OF COMMITTEE ON CONSTITUTION AND BY-LAWS.

Mr. MOON. This committee was appointed two years ago, and having prepared no report for our last annual meeting, was continued until this year. Mr. Chase, the chairman, has proposed the following changes in the Constitution:

To strike out articles I and IV, and insert the following:

Article I. This society shall be entitled "The State Horticultural Association of Pennsylvania," and its object shall be the advancement of the science of horticulture and pomology.

Article IV. The following standing committees shall be appointed: A committee of five on nomenclature; a committee of three on insects, of which the professor of entomology shall be chairman; an executive committee, consisting of the elective officers of this association, and three of whom, including the president, shall constitute a quorum; and a general fruit committee, consisting of one member from each county represented, with a general chairman of the whole, each member of the local fruit committee to have the privilege of appointing two assistants.

On motion, the report was accepted and committee discharged.

SELECTION OF A PLACE FOR NEXT ANNUAL MEETING.

Mr. SNAVELY. I nominate Lebanon. We have not met there in many years, and we will promise to do all in our power to secure a good attendance, and make the meetings interesting. We have good hotels and excellent railroad connections.

Mr. HOOPES. It is fifteen or twenty years since we held a meeting at Lebanon.

Colonel McFARLAND. I think we should meet at Harrisburg next year. We ought to look after the politicians. There are some good men in the Legislature, who could probably be interested in our work.

Mr. COMFORT. I am in favor of Harrisburg next year.

Mr. LONGSDORF. We ought to go west of the Susquehanna river. I would suggest Mechanicsburg.

A vote having been taken, Lebanon was decided upon.

Mr. SNAVELY. I wish to thank the association for selecting Lebanon for holding their next annual meeting. We will endeavor to make your stay in our midst, both pleasant and profitable.

Mr. VAN DEMAN. There is one thing that adds greatly to the interest of such meetings, especially at the evening sessions, and that is music. Some of our western societies have adopted this feature with most satisfactory results.

Mr. BRINTON. Our meetings would also have additional interest if more flowers and fruits were exhibited. Ladies would be more likely to attend and take part in our deliberations.

Adjourned.

AFTERNOON SESSION.

Having called the association to order the President announced an invitation from Mr. A. S. Shimer, of Redington, Pa., to visit his fruit houses. He stated that arrangements had been made with the Lehigh Valley railroad to stop one of their express trains at Redington for the convenience of members, and that carriages would be provided for their conveyance to and from his place.

Judge Stitzel also extended an invitation from Henry Moser, of Allentown, to visit his fruit farm.

REPORT OF COMMITTEE ON NOMENCLATURE.

Mr. President and Gentlemen of the State Horticultural Association:

The Committee on Nomenclature beg leave to report the following fruits on exhibition:

A. S. Shimer, fourteen varieties of apples, viz: Ben Davis, Smith's Cider, Krauser, York Imperial, Russett, Rox Russett, Baldwin, Black, Bellefleur, Fallawater, Search and three varieties for a name.

Joseph W. Thomas, six varieties of apples, viz: Ridge Pippin, Tewksberry Winter Blush, Pennock, Tarr's Seedling, Romanite and Grindstone.

W. M. Pannebaker, ten varieties of apples: R. I. Greening, Ladies Sweeting, Baldwin, Mumper's Vandevere, Rox Russet, Wagner, Major, Ewalt, Smokehouse and Fallawater.

R. W. Scherer, two varieties to be named.

William Springer, one variety: Wolf River.

H. M. Engle & Son, five varieties of apples: Baldwin, R. I. Greening, Ewalt, York Imperial and Bellefleur.

J. G. Rush, three varieties of apples: Smith's Cider, Griest's Winter and York Imperial.

H. Leh, three varieties of apples: Krauser, Baldwin and Schaffer. Two plates of Vicar pears.

John Kready, one variety of sweet apple for a name.

Joseph Shearer, a seedling sweet apple

J. Hibberd Bartram, Smokehouse.

Ferdinand Morehead, three varieties: Lehigh Valley Greening, Pennock and Empire.

W. W. Meech, Beurre d'Anjon pears and two jars quinces.

E. H. Hart, Federal Point, Fla., seven varieties of oranges.

American Manufacturing Company, Waynesboro', Pa., one case of evaporated fruits.

We would call special attention to the Lehigh Valley Greening exhibited by Ferdinand Morehead.

Respectfully submitted.

(Signed) J. HIBBERD BARTRAM,
JOSEPH T. SMITH.

On motion report was accepted.

Mr. VAN DEMAN called the attention of the association to the oranges exhibited by Mr. Hart, of Federal Point, Florida, and explained some of their characteristics. Among them was a specimen of the "Washington Navel," imported from Brazil by Mr. Saunders and now extensively grown at Riverside, California, under the name of "Riverside." Horticultural experts are confident that this is the true "Washington Navel." He also called attention to specimens of "Mandarins" and "Tangerines," having the same peculiar marks. He also stated that if Mr. Hart is correct this is an evidence that the pollen of one year influences the fruit the following year. Continuing Mr. Van Deman said: While on the floor, and if not intruding upon your time, I would like to say a few words as to my position and something of my work. You all know Mr. Colman's interest in horticulture, and it is his purpose to incorporate pomology so firmly in his department during his administration that his successor cannot get rid of it. Congress has recently passed an act creating a Bureau of Pomology, and I am here to represent it before your society. I hope you will aid us in every possible way, give us your advice and sympathy, and we will try to do much more for pomology than has been done in the past. We need further recognition, and ought to demand it at the hands of Congress, and you ought to demand it from your members from this State. The appropriation for the division of pomology for the current year is only three thousand dollars. It is

but a trifle, but it is a beginning and our work will likely obtain further recognition.

A motion was made by Colonel McFarland increasing the secretary's salary to fifty dollars per year. Mr. Engle moved to amend by making the chairmanship of the General Fruit Committee a salaried office and fixing the salary at twenty-five dollars per year.

Judge STITZEL. I think the secretary's salary should be increased. There is much work connected with the position, and the additional duties which will be imposed upon him in the preparation of a fruit list will justify the increase proposed. I also endorse the proposition to pay a salary to the chairman of our General Fruit Committee. Through the efforts of the present chairman, and our secretary, our society has greatly extended its field of labor, and at this time we have correspondents in nearly every county of the State. I hope the motion as amended will pass.

Colonel MCFARLAND. I accept the amendment. The present chairman of our General Fruit Committee has ably filled his position, and has devoted much time and labor to his work. Our society lives only through its officers, and they deserve some compensation.

The motion as amended was unanimously adopted.

Mr. Fox read a letter from Mr. Herr, of Clinton county, suggesting that application be made for an annual appropriation of one thousand dollars from the State to defray the expenses of our annual meetings.

Mr. ENGLE. The suggestion is a good one but the appropriation is not so easily obtained. It may be well to make an effort, and I move that a committee of five be appointed to present the matter to the Legislature.

The motion was adopted and the following were appointed on said committee:

H. M. Engle, Col. McFarland, Judge Stitzel, Josiah Hoopes and Hon. S. M. Wherry.

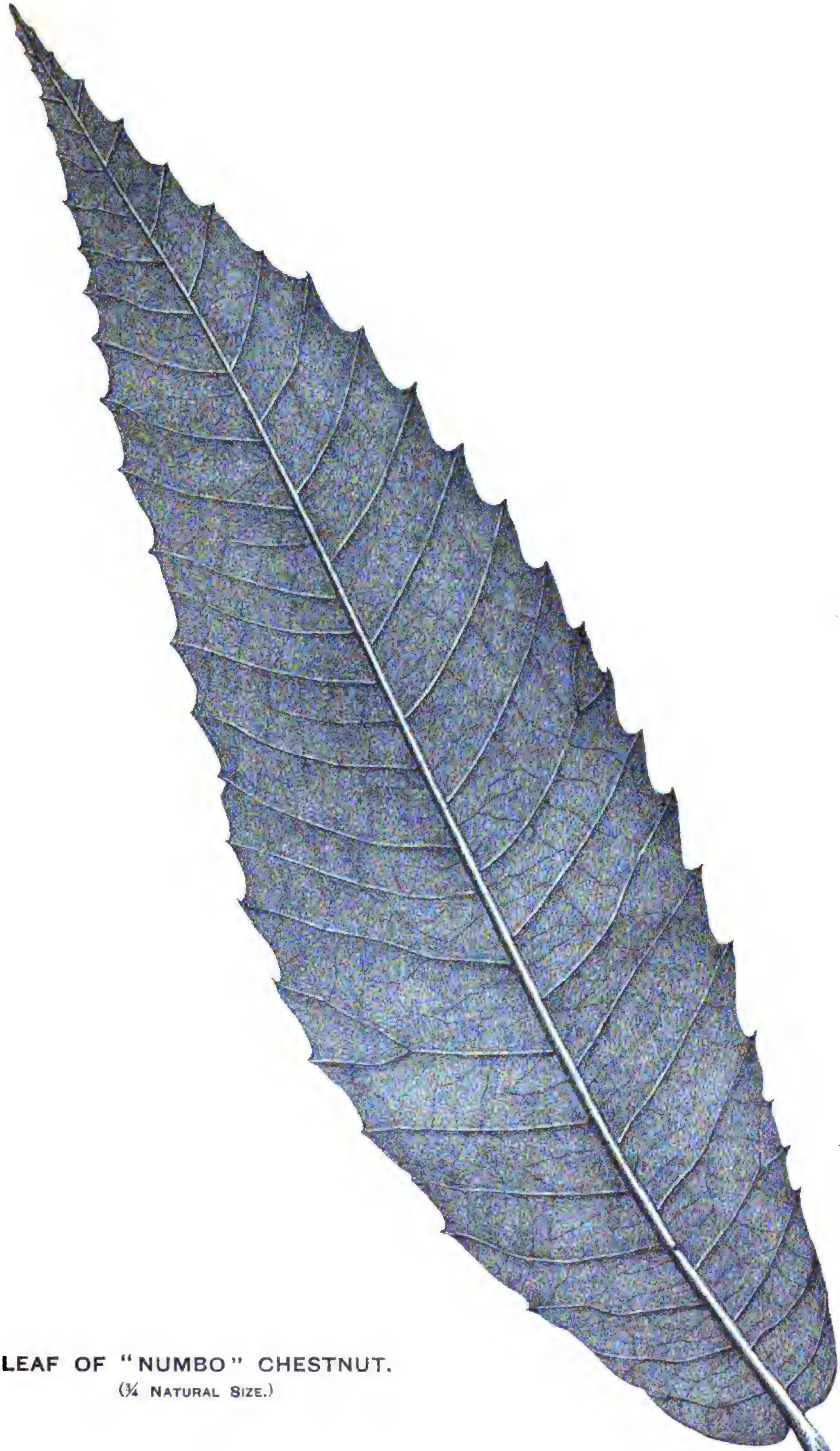
J. Hibberd Bartram, of Milltown, Chester county, read the following:

ESSAY ON THE RAISING, PREPARING AND MARKETING OF ASPARAGUS.

A few weeks ago I received an invitation from our President to represent Chester county, by writing an essay on some subject that I might choose; to be read at our meeting at this time, the first impulse was, to say no, feeling my inability in that direction, but from a sense of duty to our society I thought it my duty to do what I could, and perhaps what few remarks I might have to make would probably bring others to the floor and give their experience.

I have chosen the raising, preparing and marketing of asparagus.

Some twenty-eight years ago I planted a half-dozen rows of asparagus in my pear orchard, in two or three years it was ready for cutting and proved to be quite remunerative, but I found it was no place to have it among trees, so I procured seed and commenced to raise plants, and also to prepare ground for a new and much larger bed; I put the seed in rows four feet apart, about as we would sow onion seed, but should not be too thick, the soil was good corn land, and particularly good for white clover with which I had a good deal of trouble, gave them good cultivation and thinning where they come up too thick, and by fall had a fine lot of roots.



LEAF OF "NUMBO" CHESTNUT.
(¾ NATURAL SIZE.)

LEAF OF JAPAN CHESTNUT.
(¾ NATURAL SIZE.)

I had previously prepared two acres of ground by plowing, subsoiling and using considerable manure in raising rutabagas. The next spring, the plants being one year old, I thought I would set my ground with plants, but was discouraged by quite a prominent nurseryman; he said two-year-old plants gave the best satisfaction. However, I acted partially on my own judgment and planted about half of my patch with the yearling plants. The next spring I planted the rest of the plot. The first half planted with the yearling roots did much the best for several years. In taking up the yearling roots they separate without breaking but few of the roots, while the two-year-olds had grown so large that many of them were broken in getting them divided.

While I advocate one-year-old roots, I do not want them too small, and if they are not grown in good ground with good culture I would prefer them two years old. Planted in rows four feet apart, and two feet apart in the row, and as deep as I could well get by running three or four times in the same furrow with the plow.

In planting use a short handle hoe to draw dirt on plants, covering them about two inches when planted. After plants have come up and ground wants cultivating, put the horse and cultivator on the ridges, filling the furrows a little at a time until about harvest time, when the ground will have become level. After each harrowing some one should follow with a hoe, to right any plants that might get knocked down by a clod or otherwise.

I have known of some that made a mistake by covering their plants too deeply when planting, many of them never coming up.

While I would advocate pretty deep planting, I would not wish to put my plants below the soil, nor much below the level that the patch had been cultivated.

After cultivating and cutting this patch for some fifteen years, it seemed to be what is termed running out, the stalks being smaller, while the crowns, being so much larger, they necessarily are near the surface, so that it was difficult to plow the ground over without disturbing the roots; so I concluded to take out every other row; did so by gathering furrows on every other row and baring the others, then keeping the middles harrowed, and killed them without having the labor of plowing them out. I think I have been cutting as much off of it since having the rows eight feet apart as I did before.

Three years ago last spring I planted four acres, placing the plants four by six feet apart; have not had it planted long enough to speak from experience whether it is better that distance than the previous planting, or whether it would be better to plant closer at first, and then after cutting some few years take out a row as before.

Use bone as well as stable manure; have not always fertilized every year, but I believe it would pay us to do it; would prefer putting on the manure or bone, whichever it might be, as soon as done cutting, and plow right down, then keep clean by running the harrow between the rows after coming up until it pretty well covers the ground.

Have used some salt, having put on a car load (three hundred bushels of Turk Island), on an acre and a half at one time; have not seen that there was much fertilizing properties in it, but think it may pay to put it on the rows in the spring after we have commenced cutting and the weeds are starting.

While we may put almost any amount of salt on an old bed, young plants will not bear much. In salting one of my patches a few years

ago, I told the men to put some on the rows of plants from the seed that spring; they did so, and it killed four-fifths of my plants. Last spring the weeds seemed to be starting so strong in one of my patches when we were about half done cutting, that I took the horse and plow and threw a furrow on each side of the row, then leveled them off with the rake. It saved much weeding, and I think helped the growth of the asparagus.

In cutting we use a medium size butcher knife, called a skinning knife, the point setting back considerable; in light cutting use baskets to put them in; but when the throng of cutting comes, put the bunches on certain rows and gather them in wheelbarrows, putting the heads to the front of the barrow; have plenty of water to wash them with; dash it on the butts while in the barrow, so it takes but little washing in the tub, before laying it on the table previous to being packed. One person does most of the tying, while others pack for him. Each packer has three or four boxes, so as to grade the lengths, the string having previously been laid in. The bottom board is longer than the sides, so that the butts can be cut off readily; the end board rises above the sides, so that they can be rounded up; use No. 5 ply, twine in skeins, the skeins being just the right length to cut in four pieces. What is cut on days that I am not going to market is put in room under ice-house until market day, which is twice a week; do not like to tie it much ahead, as it shrivels and leaves the string loose; would like it all tied the day I go to market.

Carry it mostly in bushel boxes holding about twenty-one bushels, though sometimes in barrels; if in barrels, not safe to leave in barrel over night, on account of heating.

Make it a point to cut every day, and sometimes when very warm twice a day, for the oftener we go over it the evener in length we can have it; in cutting once a day in very warm weather there will have to be stalks cut that are hardly ready for cutting, if not gone over until the next day, whereas if gone over again in the evening they could be left until then. We cut about two or three inches under ground, so that we do not have the strings too near the tops, where there is so much tenderness, and also so as to have it butted in the white part or that part which grows under the ground. It also keeps much better. Stalks that are butted above ground if kept a few days will begin to decay, the juice oozing from butts, while those cut under ground will be good. Have tried different packers, but have gone back to tying by hand.

Mr. ENGLE. I would like to ask Mr. Bartram whether any of the new varieties of the asparagus have proven better than the old kinds.

Mr. BARTRAM. I don't think there is much difference, though plants of my own growing did not do so well as some that I bought from Hoopes Brothers & Thomas. I have also tried Barnes' asparagus, which has proven much finer than any I had before. It was planted further apart, which may account for the increased size and better quality. I have sold 1,800 bushels per week, 200 of which were Barnes'. The latter brought twenty to thirty cents a bunch, while the common only brought ten to fifteen cents. Prices are not so good now as when I first marketed asparagus.

Mr. HOOPES. The variety we sold Mr. Bartram was "Leshers Mammoth," which was first sent out by Mr. Dreer, of Philadelphia. It is a large, tender variety, though not quite so large as Conover's Col-

lossal. We have found asparagus one of the most profitable vegetables that can be grown.

The following essay was then read:

NUT CULTURE.

BY H. M. ENGLE, *Marietta, Pa.*

If there is any branch of horticulture overlooked more than any other, it is nut culture. However, there has been a general awakening on this subject of late, and unless the interest shown at present is only speculative, a decade or two hence will show vast advances in this important branch. Why it has been neglected so long amid the rapid progress of other branches of horticulture, I will not venture to assert. One cause to which this neglect may be attributed is, that nuts are generally considered luxuries instead of food. However, they are rich in certain food elements which are essential to the human system, especially in the winter season; and, as the public mind acquires such knowledge, the demand must increase, and with it, production and consumption in a corresponding degree. Thousands of acres might be made profitable in nut culture, that now pay neither interest nor taxes. Not only might large areas be made a source of profit to enterprising planters, but large supplies of food for man might be obtained with more certainty, than by equal amounts of money invested, and labor applied in the growth of some other crops. I do not mean to discourage the growth of fruits and vegetables, but to encourage in addition nut culture.

It will hardly be denied that if more of the natural products of the earth were eaten, and less of artificially prepared and adulterated articles, mankind would be much the better for it.

A strong argument in favor of nut culture is that so little care is required in keeping, while vegetables and fruits require special care during the winter when the former are most required and the latter least.

A reliable chemical analysis of the nutritive properties of the various kinds of edible nuts would be of great value.

Among the various nuts that can be grown in this latitude, I would place the chestnut at the head, since for quality it is unsurpassed, especially when boiled or roasted, In size the Japan chestnut exceeds all others that I have yet seen, but for quality our natives are not excelled, if equalled. The French, Italian and Spanish are of larger size than our natives, but superior quality is not claimed for any of them. Referring to French, American or Spanish chestnuts is almost as indefinite as speaking of pears, apples, etc., from these countries, as all vary when grown from seed; and therefore, by cross-fertilizing, new varieties will no doubt be produced, which will combine many if not all of the best qualities of the originals, just as has been done with so many fruits.

Looking prospectively for such results, it will be important to have new varieties properly named (as there are some now) and classified same as fruits, for among the forthcoming varieties will be large, medium and small; early, midseason and late; vigorous and slow growers; prolific and tardy bearers; hardy and tender ones, with grades of quality. In anticipation of such results we should by all

means avoid synonymous, improper names and dissemination of all inferior varieties.

Japan chestnuts have been referred to as being the largest I nave yet seen; but they were grown in Japan. A few nuts of the Japan were grown in this vicinity, but were not equal in size to some of a variety grown there, which proves either that it will not grow to full size here, or that there are different strains of them as well as of those of our own country. Whether they are fully hardy and of best quality is yet uncertain, as reports differ in these particulars.

The black walnut (*Juglans migra*), butternut (*J. cinirea*), English walnut (*J. Regia*), Pecan (*Carya olivæformis*), shellbark (*C. alba*), filbert (*Corylus Aoellana*), are no doubt susceptible of improvement as well as any other of the earth's productions. The principal improvement required in these is more kernel and less shell. To attain this result should not be more impracticable than for stockmen to increase muscle and reduce bone in animals for the shambles, or any other desirable quality they wish.

In this direction stockmen are far in advance of horticulturists, and yet it is not likely that there are greater obstacles to such procedure in the vegetable than in the animal kingdom.

Although great progress has been made in the production of new fruits and vegetables by hybridization and cross-fertilization, and the process is pretty generally understood, but much must be learned before definite results can be attained with certainty.

Nut culture opens a new field for this delicate but desirable process. In this progressive age we hardly acknowledge impossibilities in this direction, especially since wheat and rye have been successfully hybridized. To those who feel interested in improving nuts or fruits, but who lack time, or who do not feel qualified to make crosses by design, I would say, select the seeds of best fruit, and best nuts, plant and raise seedlings, even if you must draw some blanks; now and then one may be worth all the care and attention given.

The various kinds of nuts require different kinds of soil, and different locations, to produce the best results. Chestnuts thrive best in light soil, either sand, slate or gravel, and when transplanted in nursery rows, will be as sure to grow as trees in general.

Walnuts grow best in rich black loam where they are usually found native.

Butternuts are usually found in similar soils. Both are easily grown. Both bear transplanting well.

Pecan and shellbark, like hickory, have long and heavy tap roots and require careful handling. They should be at least twice transplanted and, by cutting off part of the tap root at first removal, they will throw out side roots, after which they are pretty sure to grow. In conclusion, I have only to say the field I have entered is very extensive, and much more might be said in favor of nut culture, but if this will serve to awaken any interest, or to promote discussion on the subject, the purpose of the essay will be attained, and the interest of nut culture may progress thereby.

The following from the "Query Box" was read and discussed in connection with the essay:

"Is it advisable to plant chestnuts extensively for market purposes, and will the Japanese varieties possibly prove remunerative?"

Mr. MOON. I believe that Japan chestnuts will be profitable in latitudes where hardy, but they have not proven quite as hardy as the

Spanish chestnut with us. We have found the Spanish variety, or seedlings of the Spanish, to be most satisfactory. They can be distinguished by their larger buds and ribbed branches. The leaf of Spanish chestnut is much longer than the Japan. I learn that Mr. Parry, of New Jersey, has had better success with Japan than with Spanish chestnuts, though such is not our experience. We had a tree of "Numbo" that has yielded twenty dollars' worth of nuts in a season, at about thirty years of age. They bear much younger than the common American variety, are much lower headed, and the nuts more easily gathered. From what I have seen of chestnut culture, I find there is yet much to be learned. I think there are many hillsides that could be planted with walnut, chestnut and other trees, with profit.

Colonel McFARLAND. Would it pay to grow the common American chestnut?

Mr. MOON. Yes, as long as the market is not overstocked, though it is not so productive as the improved varieties.

Mr. BARTRAM. Have not had much experience in nut culture. There were three chestnut trees on my property when I went there about thirty years ago. They are all different varieties, and I do not know what they are. One tree bore, last season, about fifty dollars' worth of nuts, and has always been free from wormy fruit. I would not recommend any but grafted trees.

Colonel McFARLAND. I have a Spanish chestnut, nine or ten years old, that grows finely, but will not bear. Probably it is not grafted.

Mr. MOON. I fully endorse Mr. Bartram's views as to grafted trees. Would never plant seedlings for fruiting.

Mr. SATTERTHWAIT. I have grown chestnuts with considerable success in the last twenty years. There is no difficulty in grafting, and there is about as much sense in planting seedling apples as chestnuts. About seventy-five per cent. of grafts will grow, and some varieties bear the second year after grafting. Chestnut culture has been profitable, but, like pear and quince culture, the market will soon be overstocked.

The PRESIDENT. I have a Spanish chestnut on our grounds, about twenty years old, that is very productive, more so than any native variety I have ever seen.

Mr. SATTERTHWAIT. Some of my trees have been overbearing, and I have been obliged to cut off branches to prevent them from breaking down. One variety on my grounds is very early, ripening fully a month before any other variety, but it is small. I always graft on the stock, never on the root.

Mr. ENGLE. We have had considerable experience in grafting chestnuts, and sometimes have had almost total failures. Have succeeded best with trees three to four feet high, top grafted. It is the general opinion that foreign varieties are not equal in quality to the native. We have a variety that has been pronounced equal in quality to the native. It was sent us by an amateur, years ago, as "Great American Seedling." May it not have been fertilized by native pollen? It is a very prolific bearer, often fruiting second year from graft. I am not afraid that the market for chestnuts will be overstocked. There is plenty of vacant land not suitable for farming purposes that could be profitably applied to nut culture.

Mr. COMFORT. In planting chestnuts, it is essential to plant good, grafted varieties. I would like to inquire what is the best method of

preserving the cions until time to insert them. Some think grafting should be done in February, but this is too early.

Mr. ENGLE. We cut cions in the fall and keep in damp saw-dust, in a cool cellar until spring.

Mr. BARTRAM. I have succeeded best by grafting late. Of those grafted early, hardly one in fifty grew.

Mr. VAN DEMAN. I remember some experiments made when with Dr. Warder, years ago. We found it essential to keep cions in saw-dust to prevent coöperation, and at a low temperature to keep from starting. When started, a cion is worthless. Mr. Joseph W. Thomas explained his method of grafting black walnut, which has generally proven a success. Mr. Meech, also, explained his method, which he claimed was simpler still.

The PRESIDENT. We have now heard all the essays. There are on our programme a number of topics for discussion. They can be read in order and taken up for discussion, or passed over, as may be de cided upon.

First Topic. "What are the most satisfactory bedding plants for the lawn?"

There being no disposition to discuss this question, the secretary read the

Second Topic. Would crowding trees serve as a protection in great atmospheric changes?"

Mr. ENGLE. In Kansas I have seen peach trees planted very closely, and it was claimed that they protected each other.

Mr. VAN DEMAN. They are not usually planted nearer than fifteen to twenty feet apart in Kansas.

Col. MCFARLAND. Some three years ago I noticed on Mr. Hovey's place, pear trees only eight to ten feet apart. Some of them were twenty-five years old. Since then I have been planting a little closer.

The PRESIDENT. Mr. Smeych, in Lancaster, has but a limited amount of room and his trees are much crowded, yet he has the finest fruit in the Lancaster market. There is another party in Lancaster who has planted plum trees only six feet apart, and they always bear good crops. Mr. Shimer has very kindly extended an invitation to this society to visit his fruit-houses, and we should take some action in the the matter.

After some discussion, during which the members expressed their regrets that other engagements, and the necessity of returning promptly to their homes prevented an acceptance of the invitation.

Mr. ENGLE moved a vote of thanks to Mr. Shimer and Mr. Moser for their kind invitations, and to the railroad company for courtesies tendered. Adopted unanimously.

Third Topic. "How can we best prevent over-production, and unremunerative prices for our fruits?"

Mr. ENGLE. If we can devise any method to prevent over-bearing we can accomplish something in this direction. Thinning is the only method, and it will pay to thin by hand rather than allow trees to be ruined by over-bearing.

Mr. SATTERTHWAIT. Retarding-houses have been a partial remedy for unremunerative prices, but they will not answer much longer. I had almost ten thousand bushels of pears the past season, some of which were kept back in retarding-houses, but when ready for market other varieties were in season and markets still over stocked.

Mr. LONGSDORF. Much of our surplus can be preserved by evaporation. Persons who make a business of evaporating fruit find it profitable. The product requires but little space for storing, and is not liable to decay. Then, it makes an outlet for surplus stock and inferior fruit, and by keeping them from the market better prices can be realized for the best grades of fresh fruit.

Mr. SATTERTHWAIT. Dried fruit could hardly be sold at any price last year, and the market seemed easily overstocked. I am beginning to cut down my large pear trees. I believe it will pay better to let them get only five or six inches in diameter and then cut them down. When small I can grow other crops between them. The fruit is also handier to gather and better.

Judge STITZEL. When in Michigan, some three years ago, I learned that evaporators were being very profitably operated. Everything is utilized, even skins and cores are used for jellies. The evaporated products are shipped westward and to the mining regions, and realize good prices.

Colonel MCFARLAND. There is always a demand for good fruit at paying prices, and I have no fears that the market will be overstocked in my lifetime. Good pears are scarce in Harrisburg, and are worth now $1.50 per basket. In fact we have had no good pears in our market for a month. Have sold some of our own at fifteen to twenty-five cents per quarter peck. Evaporating is an important industry, and will make an outlet for much surplus fruit.

Mr. MEECH. Wormy fruits and windfalls are a valuable feed for stock. Much of our surplus fruit, especially apples, can be profitably used in this way. Our horses will thrive on them, and they are valuable for milk cows. The jelly principle in fruits is richer near the skin than at any other part. This is especially true of the quince. The core of the quince makes jelly ropy, and should be thrown out. By studying their uses there will be little if any need of fruit going to waste.

Colonel MCFARLAND. I was interested in Mr. Van Deman's remarks a few moments ago in reference to the Bureau of Pomology and his work in connection with the Department of Agriculture at Washington. There has been little or no attention given to pomology hitherto by the Department, and I hail this as a move in the right direction. I offer the following:

Resolved, That we learn with pleasure that divisions of pomology and mycology have been established in the United States Department of Agriculture at Washington, and we earnestly request our Representatives and Senators in Congress to vote for such appropriation as the Commissioner of Agriculture has recommended for these measures, in justice to the pomologists of the country.

Unanimously adopted.

Fourth Topic. This subject having been discussed in connection with the "Hatch bill," was passed over.

Fifth Topic. "Should we as a Society encourage the use of Paris green for the destruction of codling moth?"

Mr. SATTERTHWAIT. How is the Paris green applied?

Mr. VAN DEMAN. In the west this method has proven satisfactory. Either Paris green or London purple can be used. They are mixed with water and applied with a force pump. The poison falls into the calyx of the fruit where the codling moth deposits its eggs, and the worm is killed before it enters the apple. Several applications should

be made before the calyx turns down. There is no danger of poison from eating the fruit, as it will all be washed away by rains before the ripening season.

Mr. ENGLE. At the last meeting of American Pomological Society, held at Grand Rapids, Mich., several members spoke of this method, and all reported favorably of its results. One gentleman spoke of having mounted a barrel on wheels for moving conveniently through his orchard, and that he was able in this way to spray one hundred trees or more in a day. Where small fruits are grown under the trees, or the orchard is used for pasture, this method would not be advisable. It was also stated that other insects injurious to the apple were destroyed by this method.

Mr. VAN DEMAN. It has proven a remedy also against canker worm. Mr. Wellhouse, near Leavenworth, had a large orchard almost entirely defoliated, and found London purple an excellent remedy. Five to six pounds of Paris green to a barrel of water is about the proper proportion.

Mr. JOHNSON. We were entirely overrun with caterpillars last season, probably they could also be destroyed by this method.

Mr. HEPLER. I have never known caterpillars to be so plentiful and destructive as last season. When the season for picking my apples had arrived, all the leaves were destroyed. Not only apple trees, but willow and maple were defoliated. The only tree not attacked by them was Norway spruce.

Mr. RUSH. They were very plenty in Lancaster county also, owing probably to favorable autumn weather.

Prof. SCRIBNER. The caterpillar referred to is probably the army worm. It is similar to some species of the caterpillar.

Sixth Topic. "Would the horticultural interests of Pennsylvania be more rapidly advanced, or could our association do more efficient work under the control of the State Board of Agriculture? Should we have a State Board of Horticulture?"

Mr. ENGLE. I don't know whether we could accomplish any more under the control of the State Board of Agriculture, but I think the publication of our reports should be entirely in charge of the secretary of the State Board.

Mr. MOON. With due respect to the State Board, I think it would be best not to pass under its control. Anything that could be done toward organizing a State Board of Horticulture might be to our advantage.

Col. MCFARLAND. I think it would be wrong to surrender the control of our reports to the State Board. Let us work alone. We have a broad field, and enough to do without taking up agriculture. I think our society ought to be represented at the State Board meetings.

The PRESIDENT. I have been requested by the secretary of the State Board to have this society represented by a committee at its meeting next week.

Mr. HOOPES. Although we have no charter from the State, we are the parent organization, and the first step toward organizing a State Department of Agriculture was taken by our society, at Chambersburg, in 1871. Dr. Frank Taylor, of West Chester, was the prime mover in this matter, and was appointed by the society to present the matter before the State Legislature.

Mr. VAN DEMAN. I don't wish to engage in this controversy, but the horticultural societies in other States, with which I am acquainted,

be made before the calyx turns down. There is no danger of poison from eating the fruit, as it will all be washed away by rains before the ripening season

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COCKLIN'S FAVORITE.

INTRODUCED BY E. H. COCKLIN, CUMBERLAND CO., PA.

Tree upright, vigorous, very productive. Fruit large. Apex sunk. Skin yellowish, shaded, and somewhat mottled in the sun with light crimson. Flesh tender, juicy, sweet, vinous. Stone small. Very good. Ripens a little later than Downer's Red.

think it best to keep independent. If I were a citizen of this State I would urge that we remain a separate body in our discussions, publications and officers.

Mr. SATTERTHWAIT. Our State board is officially connected with our State government, having its headquarters and office at Harrisburg. Our society has no connection at all with the State further than it publishes our annual reports free of cost to us. There might be a department of Horticulture on the same general plan of our Board of Agriculture.

Col. McFARLAND. Would it not be better for our society to secure a charter?

Mr. MEECH. At the last annual meeting of the New Jersey Horticultural Society a movement was made to be incorporated.

Mr. ENGLE. If our reports were under control of the State Board, we might, when necessary, have more space than the eighty pages now allowed by law. Much valuable matter must often be omitted for want of room to publish it.

Mr. MOON. I think we had better "boil down" and abbreviate our report, than endeavor to make them more voluminous.

Mr. G. B. THOMAS. I do not see any necessity for more than eighty pages. These annual reports are nearly a year in course of publication, and are seldom read when issued. I now hold in my hand a copy of the Bethlehem *Daily Times*, which contains all of importance that has been said and done to within a few hours, arranged in a concise and readable manner, and to be had at once instead of a year hence.

On motion adjourned.

EVENING SESSION.

In calling the members to order, the president announced that the treasurer was in readiness to enroll members and receive dues at any time.

On motion of Mr. HEPLER, a committee of three was appointed to represent this society at a meeting of the State Board of Agriculture to be held at Harrisburg the following week. J. C. Hepler, H. C. Snavely and H. S. Rupp were appointed on said committee.

On motion of Mr. HOOPES, Mr. H. E. Van Deman and Prof. F. Lamson Scribner, of the Department of Agriculture, Washington, D. C., were unanimously elected to life membership. Both gentlemen cordially thanked the Society for the honor conferred.

Seventh Topic. "How can we grow plums successfully, and what are the best four varieties for general cultivation?" Not discussed.

Eighth Topic. "Are seedling trees, especially peach, more regular and prolific bearers, and less liable to disease than grafted ones?"

Mr ENGLE. No.

Col. McFARLAND. Would say yes, as the result of my observations. Have one that has borne eight regular crops.

Mr. ENGLE. I had some experience years ago when not being able to procure all the budded trees I wanted, I planted some seedlings. In that case the seedlings were not as healthy, and did not bear as

well as budded ones side by side. I think Mr. Smith will corroborate what I have said.

Mr. SMITH. I have not found seedlings any more productive and healthy than budded trees.

The following letter bearing on this topic was read by the secretary:

TALLMADGE, O., *January 17, 1887.*

FRIEND ENGLE:

In the general acceptation of the term hardiness, which in trees is nearly equivalent to healthy, I am unable to reply to part of the question in topic eight; that is, I do not know whether seedling peaches will endure a colder climate than many varieties of budded ones.

Theoretically, I should say that many of them would, as it is I believe a general law of nature that high quality and a refined delicacy tend to a reduction of vigor. Certainly many of the seedling peaches are poor enough to go with an iron-clad constitution.

I think, however, there is no question on one point with all observing fruit men, and that is that the fruit buds of most seedling peaches will endure from four to eight degrees of cold more than most of the budded varieties and still retain sufficient vigor to produce fruit. This enables us to answer another proposition in the topic in the affirmative when we take a period of years into the account.

Nothing can exceed the productiveness of the Yellow Rareripe or Early Crawford when they bear, and in mild climates like New Jersey or Delaware it would probably be foolish to discuss the proposition before us; but in Ohio and many parts of Pennsylvania, where it is not safe to count upon a crop of budded fruit oftener than once in six or seven years, it becomes an important question. In my own experience of twenty years, in which time I have maintained about an equal number of seedlings and budded peach trees, I have in seven different years had a crop of seedlings when I had none from the budded trees, with the exception in three years of a full crop of Hale's Early and a partial one of Smock. The other budded trees I had were Early and Late Crawford, Early Barnard, Old Nixon, Free Stump, Large Early York and Yellow Rareripe.

Of about twenty Early Crawford and thirteen Late Crawford set eighteen years ago upon the north side of a hill but three of the former and four of the latter now remain, and they bore their first full crop last summer. For a number of years this orchard was cropped, but for the last seven years has been in grass. The price I have received for seedling peaches has varied from sixty cents to one dollar and fifty cents per bushel, Had I paid careful attention to thinning and given high cultivation, all of it would have brought one dollar per bushel and upwards in most years. Last summer a German neighbor sold from about one hundred seedling trees grown from a miscellaneous lot of pits two hundred and sixteen bushels of fruit at sixty cents per bushel.

The seedling peach orchard has, under certain conditions, two chances to the budded one's one, as it stands upon its own roots, and any accident that destroys or injures the budded stem is irremediable by a new growth from the crown, while the seedling will sprout indefinitely and continue the existence of the tree to triple the life of a budded one.

In a commercial orchard highly cultivated and carefully looked after, this chance of continuing the tree upon the same ground by

means of vigorous sprouts would be less valuable than in the slipshod no cultivation in vogue among the masses, and there are thousands who have a pretty good supply of seedling peaches in fortunate years who would scarcely ever taste peaches if they depended upon budded fruit.

On the other hand, to those who buy peaches the ordinary run of seedling peaches have slight attractions, and sales to a great degree must be forced, and a fruit-grower who depends upon a distant market and commission sales cannot grow a common seedling peach with any expectation of making it profitable.

If a grower is so situated as to peddle the fruit directly to consumers, dispensing with package, freight, cartage, commissions and retailers' profits, seedlings will, I believe, pay better than budded ones in climates where the thermometer is liable to go below eleven degrees but rarely falls below eighteen degrees.

With respect to budded peaches, there seems to be a difference in the ability of the buds to withstand cold. The semi-clings like Hales, Early Alexander, Honeywell and Allen are undoubtedly three or four degrees hardier than Early York or Old Mixon Free, and the Smock will stand several degrees lower temperature than the Crawfords.

In this connection the question naturally arises how can we improve upon or fix the character of peaches from seed? I have a friend who has given considerable attention to this matter, and I believe experimented some, and he is firmly convinced that the best way is to plant seed from the best seedlings and then again select from these. This is the well known method advocated by Von Mons and practiced by him in improving the pear and in shortening the time of bearing from seed a number of years, but was not very successful in improving the quality. The same method has been tried in improving the potato in a number of experiments in England and by the Rev. Goodrich in this country, but the results have not been as valuable as where a start was made from the best improved varieties.

The breeder of domestic animals no longer goes back to the scrub to start his attempted improvement, and the best experimenters in the improvement of small fruits avail themselves of seed of the very best kinds extant, and I can see no reason why we should retrograde in our attempts with the peach.

Judging from what has been accomplished in twenty-five years of experiment with apples in Minnesota, we can hope to do little in getting peaches more hardy than those we now have, but must turn our attention to fixing as far as possible the character of our hardiest kinds so that they will perpetuate their desirable qualities by seed.

The budding of two varieties upon one stock and surrounding the tree with mosquito bar when the intermingling branches came in bloom would doubtless produce seed of more marked character than any selection of chance fertilized pits.

Yours very truly,

L. B. PIERCE.

MR. LONGSDORF. One reason why some varieties of peaches are not so hardy is in their manner of blooming. Some blossoms are large and open, others closed and well protected. When in Tennessee a year ago I saw seedling trees that were said to be fifty years old. Much of the fruit however was small and worthless.

Ninth Topic.—"What six roses are most desirable for general culture?"

Mr. RUPP. Gen. Jacqueminot, Gen. Washington, Coquette des Alps, Hermosa, Paul Verdier and Merve des Lyon.

W. P. BRINTON. Gen. Jacqueminot, Gen. Washington, Malmaison, Hermosa and Sunset.

Mr. HEPLER. La France, Gen. Jacqueminot, Hermosa, Le Reine, Anne de Diesbach and Perle de Lyon.

Mr. CULLEN. Gen. Jacqueminot, Gen. Washington, Alfred Colomb., Rosy Morn, Capt. Christiy and Hermosa.

Mr. MEEHAN, THOS. B. Madam Plantier, Gen. Jacqueminot, La France and Hermosa.

Col. MCFARLAND. Hermosa, La France, Malmaison, Gen. Washington, Gen. Jacqueminot and Merve des Lyon.

Mr. HOOPES. Gen. Jacqueminot, Alfred Colomb., La France, La Reine, Coquette des Alps and Pride of Waltham.

JOHN CURWEN, Jr. General Jacqueminot, La France, Hermosa, Queen's Scarlet, Mad. Plantier, Mad. Gabrielle Luizet.

Tenth Topic.—"General small fruit discussion. What varieties are proving most desirable?"

Passed over without discusson.

Eleventh Topic.—"What six annuals are most easily grown and most desirable for general culture."

Mr. CULLEN. Asters, Coreopsis, Phlox Drummondi, Sweet Peas, Mignonette and Verbenas.

W. P. BRINTON. Sweet Alyssum, Mignonette, Balsams, Phlox, Verbenas and Heliotrope.

Mr. ROHRER. Phlox, Sweet Alyssum, Balsams, Petunias, Verbenas and Mignonette.

Mr. RUPP. Verbenas, Balsams, Phlox, Petunias, Pansies and Asters.

Mr. MEEHAN. Phlox, Verbenas, Balsams, Sweet Alyssum, Petunias, and Mignonette.

Mr. CURWEN. Petunias, single or double, French Marigold, Phlox Drummondi, Asters, Dwarf Nasturtium and Verbenas.

Twelfth Topic.—"What six perennials can be recommended for beauty and for best general results?"

Mr. CULLEN. Aquilegia, Helianthus, Gypsophila, Gaillardia, Coreopsis and Sweet Pea.

Mr. RUPP. Hollyhock, Perennial-Phlox, and Helianthus.

Mr. HOOPES. Astilbe-Japonica, Diceatra-Spectabilis, Aquilegia-Coerulea, Saxifraga-Crassifolia, Papaver-Grandiflora, and Campanula.

Mr. CURWEN. Paeonies, Iris, Yucca-Filamentosa, Columbine, Dielytra, Delphinium-Formosum, and Chrysanthemum.

What ten deciduous hardy shrubs are most desirable and easily cultivated?

Mr. THOMAS. Spirea Reevesii, double, Hydrangea Paniculata Grandiflora, Dentzia Crenata Plena, Weigela Rosea, Weigela Variegata, Althea Var, Spirea Thunbergeii, Purple Mist, California Privet, Magnolia.

Mr. RUPP. Hydrangea P. Grandiflora and Thomas Hogg, Spirea Prunifolia and Reevesii, Weigela Rosea, Lilac, Pyrus Japonica, Viburnum Opulus.

Mr. BRINTON. Weigela Rosea, Lilac, purple and white, Spirea Prunifolia and Reevesii, Calycanthus, Pyrus Japonica, Hydrangea P. Grandiflora, Double Flowering Almond.

Mr. MEEHAN. Hydrangea Paniculata Grandiflora, Viburnum Placatum, Exochorda Grandiflora, Chionanthus Virginica, Weigela Candida, Azalea Viscosa, Halesia Tetraptera, Cornus Florida, Rosa Kamschatka, Prunus Pissardi.

Mr. CURWEN. Deutzia Crenata, Deutzia Gracilis, Calycanthus Floridus, Forsythia Viridissima, Hibiscus Althea, Syringa, Weigela, Spirea Prunifolia, Hydrangea Paniculata Grandiflora, Cydonia Japonica.

Mr. HOOPES. Offered the following:

In recognition of the kindly welcome extended to this society at its present meeting, it is hereby

Resolved, That the thanks of the State Horticultural Association of Pennsylvania, are hereby tendered to the citizens of Bethlehem for their cordial greeting, and to the Bethlehem *Daily Times* for its very full and accurate reports of our proceedings.

Mr. HOOPES. In offering this resolution, I wish to speak especially of the very full and accurate account of our proceedings, which appears in the paper which I hold in my hand, the Bethlehem *Daily Times*. Never have I seen such a masterly condensation of such lengthy proceedings. Not one point is omitted, and I think the society will bear me out in saying that we are extremely pleased with the reports which the *Times* has given of our meeting.

President Cooper heartily endorsed the remarks of Mr. Hoopes, and the resolution was passed unanimously.

The following letter was read by the secretary:

U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF POMOLOGY,
WASHINGTON, D. C., *January 8th, 1887.*

E. B. ENGLE, *Secretary Horticultural Association of Pennsylvania, Waynesboro', Pa.:*

MY DEAR SIR: The following is a schedule, which I have arranged and present for your consideration after much careful study of the published rules and State laws, governing the meetings of the societies named in this list, and after considerable correspondence with the most of their secretaries.

That there is need of some arrangement, by which these societies may meet permanently in succession, and not at the same time, except those remote from each other, is evident to all. Members could then attend neighboring societies without neglecting their own, and the services of men of eminent scientific ability, could be more easily secured by each State. If you will bring the matter before your society at its next meeting, or proceed in any way that you deem best to obtain this end, I trust it will result in good to the cause of horticulture. Can you not in some way have your laws so changed, if need be, that your society may conform to this arrangement? If you see any serious objection to this plan, please state wherein it lies, that if possible it may be remedied.

Michigan, ...	First Wednesday in December.
Dakota, ...	First Wednesday in December.
Ohio, ...	Second Wednesday in December.
Kansas, ...	Second Tuesday in December.
Illinois, ...	Third Tuesday in December.
Indiana, ...	First Tuesday after first Monday in January.
Colorado, ...	First Tuesday after first Monday in January.
Nebraska, ...	First Tuesday after second Monday in January.

Kentucky, ... First Tuesday after second Monday in January.
Iowa, ... First Tuesday after third Monday in January.
Pennsylvania, . . . First Tuesday after third Monday in January.
Minnesota, ... First Tuesday after fourth Monday in January.
Missouri, ... First Tuesday after fourth Monday in January.
Wisconsin, ... First Tuesday after first Monday in February.

These are intended for the *annual* meetings. You will observe that those occurring at the same time are adjacent.

Respectfully submitted.

H. E. VAN DEMAN,
Chief of the Division of Pomology.

Mr. VAN DEMAN. My object in sending this communication to your secretary was to arrange a schedule of dates so that societies in contiguous States might meet in succession and not at the same time. By the arrangement proposed members can attend the meetings of societies in other States without neglecting their own. The services of eminent scientists could also be more easily obtained by each State.

Mr. HOOPES. I suggest that Mr. Van Deman embody his idea in the shape of an amendment to our by-laws. It can then be received and laid over for final action until our annual meeting.

The following committees were announced by the president, those first named being chairmen:

On Arrangement—H. C. Snavely, Colonel G. F. McFarland and E. B. Engle.

On Exhibition—W. H. Moon, P. C. Hiller, H. A. Chase, Gabriel Hiester and George D. Stitzel.

The following was offered by Mr. Van Deman and laid over until next annual meeting:

Resolved, That article 3 of the by-laws of this society be so changed so as to fix the date of our annual meetings on the third Wednesday after the first Monday of January of each year.

Adjourned.

[The following essays were omitted from last year's report for want of space.]

INFLUENCE OF FORESTS ON TEMPERATURE AND RAINFALL.

By SIMON P. EBY, *Lancaster*, *Pa.*

A lady can cool her face with a fan because, by its use, the atmosphere around her is put in motion, the heated particles nearest her driven away, and their place supplied by other and cooler air. A boy will blow his nails when cold with the warm breath of his mouth. Both know from experience that atmosphere carries alike heat and cold.

In a similar manner, but on a larger scale, currents of air coming from the colder regions of the north will lower the temperature in the track over which they pass, while currents coming from the south will raise the temperature by the heat they bring with them.

The degree of change affected will depend much upon the rapidity with which these air currents move, their extent and duration, and any obstruction placed so as to hinder or check their motion will necessarily lessen the suddenness and degree of change they bring about.

Winds on the level plains, where there is no timber, move faster and acquire greater force than when they move across a hilly country or when they have to struggle through extensive forests. The fierce blizzards, before which men and beasts must fly or perish, occur on the treeless plains and prairies. The storms that overwhelm caravans with hot air and sand blow on the deserts.

Even hills without trees check the wind but little. Mr. Emerson, who made this subject his especial study, in his report to the government of Massachusetts says: "The laws of the motion of the atmosphere are similar to those of water. A bare hill gives no protection. The wind pours over it as water pours over a dam. But if the hill be capped with trees the windy cascade will be broken as into spray. Its violence will be sensibly diminished."

Those who have never encountered a gale of wind on the plains can form no adequate conception of its fury. An intelligent citizen of my county, who lately visited the plains of the West, gave me his experience of a day's drive in what was there considered an ordinary summer gale. Hats could not be kept on the heads, consequently the parties provided themselves with caps and tied them down. At times it was hard for the horses to be kept in their course, and it seemed as if the wagon on which the party rode would be lifted from the ground. It was a constant, steady blast. To show what effect a small grove of trees had, he stated that at one place they were obliged to get to the lee side of a patch of some three acres of timber, planted by a Scotchman only about eight years before, to enable them to hold a conversation with the proprietor.

So we see that trees, whether in the hill country or upon the plains, serve as wind-breaks and contribute largely to keeping the temperature uniform, or what is called seasonable.

Besides serving as wind-breaks, forests and woods have a local influence upon the temperature. It has been ascertained by careful observation that they are not liable to the same extreme degree of heat or cold as cleared lands are. During winter the ground does not freeze as hard or deep in the woods as on the adjoining clear fields—cooler during the day and warmer during the night than the cleared lands. Such a steadying of the temperature locally has its beneficial effects upon vegetation growing upon the adjoining lands.

Hence, while the *average* temperature of the eastern portion of our State, taken all the year round, may not have changed much either way from what it was sixty years ago, when more of it was yet under forest, there can be no doubt the climate has become more variable since the woods have been cut down, and it gets cold or warm more suddenly in all seasons, as the winds, which have now a clearer sweep, blow from the north or south.

Notice the protection a garden wall, an evergreen hedge, or even a closed board fence will give to plants and half-hardy shrubs, then multiply the effects of these with the thousands of acres of pine and deciduous forests that stood as barriers to the winds coming from all quarters, and you can form some idea of the vast amount of protection the latter gave to the country and the corresponding change that would necessarily follow their removal.

Rainfall.

The other branch of our subject, " Whether forests have any influence upon the rainfall," has become a somewhat mooted question. We have been told by those who hold a different opinion that it has been ascertained by actual measurement that the rainfall of to-day is no less than that of sixty years ago.

If this were true it would settle the question beyond controversy.

Has it been so ascertained, and by whom?

Can it be shown that a correct record of the rainfall has been kept at any place in the interior of Pennsylvania sixty or even fifty years ago, when the forests were yet standing, and that no more rain fell during the year than falls at the same place now when the forests have been cleared away? I think not. At any rate I have never heard that this was done.

In contradiction of this assertion it appears that, since the cutting away of the forests the springs in their vicinity have become lessened in volume, many of them gone entirely dry, and the streams fed by them so much lowered that they no longer furnish the water power to do the work they did sixty years ago, but must be supplemented by a steam engine at nearly every mill. This is the case at least in Lancaster county.

Now, if the same quantity of rain still falls, we would like to know what becomes of the water.

They say it runs away much faster after the rainfall since the forests have been cut.

This is, in part, true, but if our opponents admit this much they yield the argument, because if it is admitted that forests hold the rains when they fall, they necessarily prevent destructive floods, restore the springs, and become of so much importance, even in this respect alone, as will justify their judicious restoration, and this is the main point we wish to establish.

LEAF OF "GREAT AMERICAN" CHESTNUT.
UPPER SURFACE.
(¾ NATURAL SIZE.)

LEAF OF "GREAT AMERICAN" CHESTNUT.
LOWER SURFACE.
(¾ NATURAL SIZE.)

This, however, is not all the influence forests have upon rainfall.

What causes rainfall?

We answer it is the result of *evaporation* and *condensation*.

As our friend Mr. Meehan explained on a former occasion: "Take a pitcher of cold water on a warm day, moisture gathers on the outside of the pitcher, and we commonly say the pitcher sweats, but it does not. It is simply the moisture in the atmosphere, which, being warmer than the outside of the pitcher, causes the water to condense. The same process is going on over the surface of the globe. Three-fourths of the globe is water, and the average evaporation is about twelve thousand pounds per square foot per annum. Of course, in some places it is less, and in some more. What becomes of this water? It is taken into the atmosphere and brought into cooler currents; it condenses and falls."

Evaporation and condensation are not confined to the seas; they are going on wherever there is moisture and heat.

This has been shown by placing a flower pot with a plant under a close-fitting glass cover. The moisture rises and condenses against the inside of the glass and flows back into the pot, watering the plant, so that no additional watering is necessary for a long time.

Flood a room with water, having a bare floor so inclined that the water will run off, and the floor will soon be dry, leaving but little dampness in the room. Cover the floor with carpet or matting that will retain the water and both floor and room will remain damp for a long time.

So in a forest, the ground being matted with roots and covered with leaves and mosses, serves as a carpet, retains the rainfall, and keeps the ground and woods damp and the atmosphere around and above it cool.

As already stated, the temperature of the forest is warmer in winter and during the summer is cooler in day time and warmer at night than cleared lands.

Now, let a cloud charged with moisture on a warm summer's day come in contact with the cooler atmosphere of the forest, and what happened on the outside of the pitcher, and under the glass cover of the flower pot, will be repeated—the moisture of the cloud will be condensed and descend upon the forest as rain.

The rain falling into the forests will not flow off, but be retained, and either percolated through the soil into the springs or be evaporated through the foliage of the trees, and furnish moisture for new clouds, to be again returned in successive rain-showers there or elsewhere. Moist places attract rain-clouds. We see that local rains during the summer have a tendency to follow each other in the same track, and also to move along mountain ranges or large streams where there remain more forest and moisture. They will avoid cleared land that has become dry and heated. Clouds have even been observed to withhold the rain while passing over treeless districts and empty themselves into the adjoining forests.

Let me cite a few authorities in conclusion. George P. Marsh, Esq., United States Minister to Italy, who made this subject his study both in Europe and in this country, and whose investigations have been more thorough, and who consulted more authorities *pro* and *con* than any other person, living or dead, in his work, which ended only with his life, entitled "The Earth as Modified by Man," says of the influence of woods on rain-fall as follows, page 189:

"The forest, being a natural arrangement, the presumption is that it exercises a conservative action, or at least a compensating one, and consequently that its destruction must tend to produce pluviometrical disturbances as well as thermometrical variations. And this is the opinion of perhaps the greatest number of observers. Indeed, it is almost impossible to suppose that under certain conditions of time and place the quantity and the periods of rain should not depend, more or less, upon the presence or absence of forests, and without insisting that the removal of the forests has diminished the sum total of snow and rain, we may well admit that *it has lessened the quantity which annually falls within particular limits.* * * * If the air in a wood is cooler than that around it, it must reduce the temperature of the atmospheric stratum immediately above it, and, of course, whenever a saturated current sweeps over it it must produce precipitation, which would fall upon it or at a greater or less distance from it."

On page 191: "I believe that a majority of the foresters and physicists who have studied the question are of opinion that in many, if not in all cases, the destruction of the woods has been followed by a diminution in the annual quantity of rain and dew." * * *

Among recent writers he cites Clave, Schacht, Sir John F. W. Herschel, Hohenstein, Barth, Ashjornsen, Boussingault and others, who maintain that forests tend to produce rain and clearings to diminish it, and they refer to numerous facts of observation in support of this doctrine. Page 192; note.

He further states that by actual measurement with rain gauges made by a sub-director of the forest school at Nancy, in France, during a period of three years, one of the gauges being kept in the center of the wooded district, one on its borders, and another in the open country in the vicinity, and the rainfall showed one thousand at the first place, nine hundred and fifty-seven at the second and eight hundred and fifty-three in the open cultivated country.

At another place a similar test during the months of February and July, inclusive, showed a rain-fall of one thousand nine hundred and twenty-five over the forest and one hundred and seventy-seven in the open ground three hundred metres (about four hundred and twenty-five yards) from the forest.

And he concludes (page 194–5) by saying: "The experience of observing persons confirms the common saying, 'All signs fail in dry times,' for which," he adds, "there is a physical reason. After a drought of some days, which generally occurs only after a protracted continuance of hot weather, the surface of the ground is not only dry but heated, and like any other body of elevated temperature throws off heat into the atmosphere. This heat tends to make the air capable of containing more humidity, and the vapor held in the atmosphere over an extent of heated ground, and which otherwise might be precipitated and form rain is dissipated and carried off. Thus the clouds that gather round mountains are seen to vanish as they pass over the plains below. The forest does not become heated by the sun, and therefore does not radiate heat enough to dissolve the vapor, in the atmosphere above it, while the open ground is warmed by the sun and radiates heat into the air which drifts over it.

These observations correspond with my own made both before and since Marsh's book was written.

Numerous other facts might be added in further support of what

has been said if time would allow. I will quote only one or two from Hough's "Report on Forestry," published at Washington.

"There is a portion of Hancock county, (Maine), along the coast that is now nearly denuded of trees. During the heat of summer the radiation from the parched surface, affects the atmosphere to excessive dryness. The electrical rain-bearing clouds that approach from the westward, as they come within this dry atmosphere, are absorbed and dissipated before their watery contents reach the earth, while the clouds just north of them float on over a better wooded district and yield copious rain-fall; and on the other hand, the showers continue abundant in the more humid atmosphere of the contiguous bays and ocean. The observing sea-faring inhabitants of that district after years of perplexity over the fact and the hidden cause, at last inquired in all seriousness, whether a telegraph wire, located to the north of them, does not unfairly 'switch off' the showers that rightfully belong to them."

The commissioners who prepared a report on the disastrous effects of the destruction of forest trees in Wisconsin (1867) observe that, "In the hot and dry plains of our southwestern territory we often see clouds passing overhead that reserve their contents until they have passed from these almost desert regions. These clouds frequently present all the actual appearance of rain in the higher regions of the atmosphere; and the fertile giving drops are seen to fall far down toward the earth, only to be dissolved and dissipated in the lower strata of the air, heated by the reflection from the parched earth which these rain drops did not reach." (Hough's Report on Forestry, page 294).

INSECTICIDES AS STUDIES.

By Dr. S. S. RATHVON.

" What is one man's meat is another man's poison," has long since passed into a homely proverb, and doubtless, with some qualification, it approximates the truth. And, this is especially so, when we apply this proverb to the various antidotes that have been employed for the destruction of noxious insects. Perhaps no single substance (except it be a highly concentrated mineral poison) can be regarded as a universal remedy for the prevention or destruction of all kinds of insects. Black pepper, tobacco, cayenne pepper, or ginger root, either finely pulverized or in decoction, will kill many species of insects, and yet nothing is more common to the druggist, the grocer and the tobacco manufacturer, than to find these very substances in their shops infested by other insects. If there is any one remedy, in any sense, general in effects, it is *heat;* but this cannot be made practicable, except in a very few cases; moreover heat is not a tangible substance, but an element.

The subject of insecticides is a *study*, and one in which is involved close observation, patient perseverence, and a practical series of intelligent experimentations. Theory is of little account in the matter —all, or nearly all, is embodied in experimental realization. There

is no room for mere inference. If a particular substance and a particular application of it has been successful in destroying one species of insects, we have no sure ground to infer that it will be of like efficacy in another case, until we have proved it by experiment.

If the subject of insecticides constitutes a study, then there should be students devoted to it; and those students, very naturally, should come from among the men who most frequently come in contact with noxious insects, whose interests are most at stake; and who are most accessible to this field of labor. It is a study that cannot be successfully pursued in the closet alone, it needs also the field.

The closet may furnish theory in abundance, but that is not what is wanting. Good thorough field experience is the great need, and that must eventually come.

Some years ago the *Journal of Forestry*, published in England, contained an editorial to the effect that a farmer in New York State had either driven away or destroyed a very large number of caterpillars that had nearly defoliated his fruit trees, simply by boring a small augur hole in the trunk which he filled with the "flour of sulphur," and then drove in a tight plug. Within twenty-four hours every caterpillar had left the trees. The editor added that this was a very simple remedy, and coming through a respectable American agricultural paper, it was worthy of a trial. The theory was, that the circulation of the sap carried with it some property in the sulphur that was hostile to the life or the comfort of the caterpillars, and hence they almost immediately abandoned the trees. Now, boring holes in the trees, filling them with sulphur, and the caterpillars' almost immediate departure, may all be facts; but the theory and the causes of the abandonment are destitute of foundation. It is on record that years after such a sulphur dose had been administered to a tree, and a new bark had covered the wound, said tree—which had been blown down, was cut and split into cord-wood, when the sulphur was found nearly as dry as it was when it was first introduced into the tree. Everybody knows what an effort it requires to mix loose flour of sulphur with a liquid, especially with water, and when packed tight in an augur hole, it would be still more difficult for liquid sap to pass through it. Again if there is an active principle in sulphur, sufficient to repel caterpillars by merely passing through the circulation and visiting the foliage, one would naturally suppose that it would also injure the foliage and the quality of the fruit, if it did not kill them altogether.

Irrespective of all theorizing on the subject the naked *fact*, is that the caterpillars had about completed their larval development when the sulphur dose was administered, and then they descended and burrowed into the earth, and transformed into chrysalids. This is the habit of many of the leaf-eating caterpillars—especially of the "canker-worms," the larva of the "hand-maid moth," and a very large number of other species of "natural moths."

A teacup full of pulverized plaster of paris, mixed with double the quantity of oatmeal, to which add a little sugar; then strew it on the floor or in the chinks where they frequent has been for years going the rounds of the secular press, a remedy to kill cockroaches. That there may be something in it, and the why and wherefore of the killing, I will here record an experiment made by the late Jacob Stauffer, of Lancaster, Pa. His kitchen became badly infested with cockroaches, which were exceedingly destructive to any edible left exposed. He may

have seen the above paragraph, in some of his papers, but whether he did or not he made trial of it, or something similar to it. He took wheat flour, finely pulverized plaster of paris, and fine granulated sugar, in about equal quantities, thoroughly mixed, and set it in his kitchen at night in a shallow dish. Next morning he found the dish entirely empty, and no roaches to be seen near it. On a further exploration he found two or three fat, well fed roaches, near the margin of the fireplace where they had made their ingress, lying on their backs, seemingly in their last agonies of death. Being curious to know how such an apparently mild remedy could affect them so mortally he made a "post-mortem" examination of them, and found in their stomachs hard plaster of paris concretion, perhaps too large to pass through the intestinal canal, which doubtless produced a "cramp-colic" of which they died—literally of "gravel." That experiment ended the incursions of the cockroaches in his kitchen for that season, they either all died, or left the premises in disgust, rather than carry about a stomach full of stones. Cockroaches are orthopterous insects; so also are grasshoppers, the various kinds of crickets, as well as the true locusts—all masticatory insects; and if they could be induced to devour the remedy as voraciously as the roaches did, it no doubt would also destroy them.

In this case theory was reduced to practice, for it illustrated how the plaster affected them. Every one knows that plaster of paris may be mixed with water almost to the consistency of milk or whitewash, and in a few minutes it "sets" and becomes hard. The salivary secretions of the insects moistened the flour and gypsum, and dissolved the sugar, and after passing into the stomach it hardened.

The Striped Apple Tree Borer.

Superda bivittata.—As the specific name implies, it would have been more definite, and therefore more appropriate to have named this insect the two-striped, or double-striped apple-tree borer, than simply the "apple-tree borer," which is so prevalent amongst those whose trees are the victims of its destructive infestations; mainly, because there are a number of "borers" that infest the apple tree; and also, because this insect infests the hawthorn, the pear, and the quince, so that it cannot be regarded as essentially *the* apple tree borer, but merely an apple-tree borer.

In the month of June, 1849—six and thirty years ago—we saw and captured the first specimen of this beautiful *Longicom.* Not on an apple tree however, but on a hawthorn hedge, in the vicinity of Lancaster city; and we captured it in the same locality, and on the same hedge for several years in succession, and before it was generally known in Pennsylvania, as an apple-tree borer. It seems a little singular that between the years 1841 and 1848 we should have canvassed the ground east, west, north and south of the borough of Marietta without capturing—or even seeing—a single specimen of this insect; and with a zeal and a vigilance, too, that we have never felt or exercised, from those days down to the present time. We even in York county, captured a single specimen of the rare species *Superda calcarata*, but never a *bivittata.* Within five years after we first captured it, we took out of the base of an apple tree, not three inches in diameter, six or seven specimens of the two-year-old larva of this insect, here in the city of Lancaster, without knowing positively that they

were "superdaus," at the time. And yet during all this time, we may reasonably suppose that the striped apple-tree borer existed, to some extent, in the localities referred to; from that period down to the present time it has been yearly increasing in numbers, and in some districts is the bane of young apple trees. When trees become very large, a few borers do not affect them much. but this is quite otherwise when trees are young and tender.

This species of *Superda* is "a native to the manor born," and from time immemorial has infested the wild hawthorn; but, as the native forests, including the wild hawthorns, were removed to facilitate the progress of improved agriculture and horticulture, the apple orchards which sprang up furnished a better quality and a more ample quantity of insect food, and the insects gradually transferred the field of noxious infestation from the hawthorn to the apple, the pear, and the quince, as furnishing more prolific conditions for the perpetuation of the species. It ever has been thus, it ever will be thus, so long as insects exist, or anything grows upon which insects can feed—they will choose that which is most accessible, most abundant and must nutritious, according to their respective natures. The habits of the apple-tree boror is not the only illustration of this characteristic, nor yet the most conspicuous one. When we first commenced the collection and preservation of insects—something more than forty years ago—the "Colorado potato beetle" was, in a measure, unknown. that is, it was unknown as an enemy to the potato plant. It is true. Thomas Say, who was naturalist to Major Long's expedition to the Rocky mountains, as early as 1824 described this insect as *Doraphora 10-lineata*, having found it on the upper Missouri river; but, although not "uncommon" in that locality, it probably was not more abundant than our *chrisomela* (*Doryphora*) *trimeculata*, of which we usually met about a dozen specimens during a summer season. We believe Mr. Say found it feeding on a wild solanaceous plant. How long this insect had existed in those far western regions before its discovery by Say is, of course, unknown; but, as soon as they were opened up to emigration and civilization, and the potato was cultivated in proximity to their ancient domain, they abandoned their comparatively harsh and sapless plant, and took to the more succulent vine of the potato, and began their travels through the potato regions.

The destructive character of this apple-tree borer, however, was known about Albany, N. Y., as early as 1825 or 1826, but not in any special degree in Pennsylvania—at least not in Lancaster county. While preferring the apple, it also infests the pear, the quince, the mountain ash, the June berry, and various thorn bushes. As a preventive of the female depositing her eggs (which she always does at the base of the tree, during the months of June and July) the free use of alkaline solutions have been recommended; and experiments have demonstrated that they repel the females and prevent them from depositing their eggs in such places. Soap solutions applied in the early part of June, and continued until the middle or end of July, will certainly act as preventives for that season, but can have no effect on the worms inside of the trunk. When a tree is young and has still a smooth bark, the first years operations of the young worms will be noticed in the discoloration of it. But after the worms penetrate into the hard wood it is difficult to dislodge them; still it has been accomplished by the insertion of a barbed still wire. They are also sometimes detectable by their castings, but when they are located farther

from the surface, these castings are not thrown out, but are packed in the gallery of the borer behind it.

The "striped" or "round-headed" apple-tree borer is by no means alone in its boring operations, there is also a "flat-headed borer" (*Chrysobothris femorata*), the "long-horned borer" (*Septostylus aculifet*), the "stag-beetle" (*Sucauus dama*), the bark-bettle" (*Monarthrum mali*), the "big-eyed click bettle" (*Alaus occulatus*), the "rough osmodenna" (*Osmodenna scabra*), and very many others. The last three, however, are generally found in the dead and decaying wood.

One hundred and fifty different species of noxious insects, have been described as attacking the roots, the trunks, the branches, the twigs, the buds, the foliage, the flowers and the fruit of the apple; from which it must be evident, that a college of practical entomology must become one of the institutions of the future. Insects are facts, their destructions are facts, and they must be met with facts, not theories.

The agricultural department at Washington city, has for some time been trying to develop an insecticide in *Pyrethrum*, and perhaps to a certain extent it answers a good purpose, but according to reports made on it by different persons it is of very little account, especially in cases so "desperate" as to require "desperate remedies." I believe the most recent essays of the department have been in developing a "kerosene emulsion," but even in this there seem to be a diversity of views, both into effects on the insects, and on the trees or plants treated; some going so far as to say that the naked kerosene itself, is not injurious to the plants.

This emulsion is composed of kerosene, milk and water; the proportions differ according to the hardiness of the plant, or the tenacity of insects. One formula gives one pint of kerosene, one quart of fresh milk and five gallons of water; but it must be rapidly agitated while it is being used, else the kerosene will float on the surface. Another formula, is one pint of kerosene, two fluid ounces of milk and two ounces of water. These tests were made by a correspondent of the department, and he claims both to have been effectual in destroying the orange bark louse.

The formula used at the department, is as follows, kerosene oil one gallon, cow's milk half a gallon, and water six quarts. Stir the milk and the kerosene thoroughly until it has the appearance of thin butter and then gradually add the water. Then dilute further if found necessary. Apply with a spraying machine. This is considered better than alkalinous or saponaceous washes. Bark lice are proverbially hard to kill, and if this emulsion kills them, it would not doubt kill any other insect.

The subject of insecticides and their intelligent application, is not to be considered subordinate to any other labor connected with fruit growing. It is ever becoming of more primary importance, and should command the first, and the coöperatives attention of all engaged in horticulture, as well as general agriculture.

REPORT

OF THE

PENNSYLVANIA STATE DAIRYMEN'S ASSOCIATION,

1887.

LIST OF OFFICERS.

President,

J. B. PHELPS, Conneautville, Pa.

Executive Committee,

A. M. FULLER, 1st Vice President, Meadville, Pa.
J. C. SIBLEY, 2d Vice President, Franklin, Pa.
W. P. HAZARD, 3d Vice President, West Chester, Pa.

Secretary,

R. H. ODELL, Meadville, Pa.

Treasurer,

W. W. DEAN, Meadville, Pa.

Vice Presidents,

I. P. Thomas,	Delaware county.
Milton Darlington,	Chester county.
Eastburn Reeder,	Bucks county.
Hon. Leonard Rhone,	Centre county.
Asa R. Sturterant,	Crawford county.
Joseph B. Powell,	Crawford county.
A. N. Perrin,	Crawford county.
John Cole,	Crawford county.
G. W. Carroll,	Erie county.
W. G. Moore,	Bucks county.
Alfred Paschall,	Bucks county.
Earl Love, Jr.,	Susquehanna county.
Joseph Kennerdell,	Lawrence county.
Geo. Blight.	Philadelphia.
Joseph E. Gillingham,	Montgomery county.
S. S. Spencer,	Warren county.
O. B. Fell,	Mercer county.

CONSTITUTION

OF THE

PENNSYLVANIA STATE DAIRYMEN'S ASSOCIATION,

Adopted April 13, 1871, Amended January 18, 1882.

SECTION 1. This organization shall be known as the Pennsylvania State Dairymen's Association.

SECTION 2. Its purpose shall be to improve and develop the dairy resources of Pennsylvania.

SECTION 3. Its membership shall consist of such persons as shall pay into the treasury the requisite fees, and of honorary members. The fee for permanent membership shall be one dollar, and for annual membership fifty cents.

SECTION 4. Its officers shall consist of a President, Secretary, Treasurer, and twenty Vice Presidents.

SECTION 5. The Executive Committee shall be composed of the president. secretary, treasurer, together with the first three vice presidents, and shall have the oversight of the affairs of the Association, the appointment of its meetings, and all arrangements for the same, including the annual meeting for the election of officers.

SECTION 6. It shall be the duty of the Secretary to keep and prepare for publication the transactions of all meetings of the Association each current year, embracing such papers as shall be approved by him. The Treasurer shall keep the charge of the funds of the Association, and shall disburse the same on the order of the Secretary, countersigned by the President, and shall report receipts and disbursements at the annual meeting.

SECTION 7. Amendments to this constitution may be made at any annual meeting, by a two-thirds vote of the members present.

THIRTEENTH ANNUAL MEETING

OF THE

PENNSYLVANIA STATE DAIRYMEN'S ASSOCIATION

Held at Meadville, Pa., February 23 and 24, 1887.

The thirteenth annual meeting of the Pennsylvania State Dairymen's Association met last Wednesday at Library Hall. The President, M. W. Oliver, of Conneautville, not being present, the first vice president, A. M. Fuller, called the meeting to order, and L. C. Magaw was chosen president *pro tem.* After the appointment of the necessary committees Mr. Magaw entered upon the subject assigned him—The Creamery and Cheese Factory. The various features of the subject were discussed in detail, and participated in by those interested. Various features of the dairy business were referred to by Mr. Magaw, especial stress being given to the condition of the butter market which, the speaker showed, has been declining for several years until he can see no encouraging features in the butter line of the dairy business. On the other hand he sees more encouragement in the production of cheese, which is scarce throughout the world.

Mr. Magaw was asked to give some information as to the net average returns per hundred pounds to the producer for milk made into cheese. He thought an average would be from eighty-five to ninety-two cents per hundred.

Mr. J. B. PHELPS thought seventy to eighty cents per hundred nearer correct.

Mr. ASA R. STURDEVANT thought raising calves as profitable, perhaps, as either cheese or butter. He raised eighteen calves last year and sold seventeen of them for $3,275. This was on the milk of eighteen cows; calves were sold before they were a year old.

G. W. CARROLL, of Erie county. People of his section are given to raising calves. Last year they sold the calves at about nine dollars a head. Perhaps Mr. Sturtevant's were worth from ten to fifteen dollars for the butcher's block, the balance of the price was moonshine. All cannot sell moonshine at that price.

Mr. JOSEPH B. POWELL. The remark that all above the price commanded by calves for the butcher's block is moonshine, should not go unanswered. The fact of Mr. Sturtevant's success is that his calves were pure bloods and the best of their breed. Like results may be had with any of the leading breeds. The east cannot compete with the west in supplying the butchers' stalls, hence we must look after the best breeds and pure bloods in order to reap the best reward.

Mr. G. W. CARROLL. I purchased some pure blood stock, and I have got them yet. I have cows that I would not take fifty dollars for, but they are not worth it. If we all go into the pure blood stock business. If we do, where will we be able to sell? This pure blood is inaugurated to a large degree. I imagine if I had some pure Ayershires I could produce about twice as much. The gentleman who purchased of Mr. Sturtevant, in his imagination, thought he was going to make a good

thing. He has got the calves, and expects to sell at Mr. Sturtevant's prices. He never will. The stock is puffed up.

Mr. CRAWFORD believes that Mr. Carroll was about right in his opinion as to a good deal of moonshine, and stated that Jerseys can now be bought near Franklin at almost any price. Can buy a full blood Jersey registered at thirty-five dollars.

Mr. CARROLL again took the floor, and said he found out by experience that there is no money in raising calves.

Mr. McKINNEY thought it had come to be about time for a discussion on the subject of butter and cheese. We want to find out which is the most profitable.

The PRESIDENT, Mr. Magaw, then stated that he believed that there was some truth in what the former speaker said. There are some cheese-makers who cannot make good cheese. Some factories will take young and unexperienced men at low wages and expect to make good cheese. There is hardly a factory in the country but what needs more or less overhauling. Then comes the choice of workmen. It is quite a science to make good cheese. It is more a science than to make good butter. I send cheese from here to the extreme west, to the extreme south, and as far as Liverpool east.

Mr. PHELPS stated that he would like to hear from some of the creamery men. He believed that the cheese-maker would be away ahead of the creamery this summer.

Mr. CARROLL followed favoring the opinion of the last speaker.

Mr. J. C. McCLINTOCK stated that he keeps a private dairy, manufactures gilt-edged butter, which averages over twenty-five cents per pound the year around. Has thirteen cows, each cow averages seventy-five dollars. Never count on the calves, for the reason I can make more money otherwise.

Mr. MAGAW stated that with seventy-six patrons in a creamery, using the Fairlamb process, they made a complete failure. In the seventy-six there was but three satisfied.

The PRESIDENT then stated that he had received a letter from Hon. M. W. Oliver, president of the Association, who had written that he would be unable to attend because of the indisposition of his assistant employed on his place.

Again the subject was taken up, and the feeding of calves was pretty generally discussed.

Mr. EDMUNDS, of Sherman, N. Y., having arrived during the afternoon, was called upon to say something about butter and cheese. He said: "Last season I had thirteen cheese factories, making full cream cheese. Some of the farmers have been wanting to go into the butter business, and I have heard so much talk of calves, that I concluded to try the creamery. We had two machines set up. First I had eight patrons on the separator side and twenty-four on the cream gathering side, using the Fairlamb can. The patrons kept coming to the separator until we had ninety-eight, and the patrons of the Fairlamb can dropped off until we had only three. We started the creamery with one hundred and twenty cows and wound up with over one thousand five hundred.

The speaker then gave a statement of the amount of work done at the creamery, and concluded by saying: "I think if you consult your own interest you will make cheese the coming season. I have a local trade for all the butter we make. The price of butter will not be higher next summer.

THURSDAY MORNING SESSION.

President *pro tem.* MAGAW, called the Association to order and briefly stated that as there was not a large number present it would be advisable to hear reports of officers, leaving the subjects fixed for this morning to a late hour.

TREASURER'S REPORT.

Treasurer W. W DEAN presented his report for the year just closed. The following are the totals as given in the report:

Cash received from former Treasurer,	$566 79
Expenditures,	497 50
Balance in treasury,	$69 29

On motion the report of the Treasurer was referred to the following auditors: G. W. Carroll and George Spitler.

The Secretary suggested a committee on resolutions, to draft resolutions expressive of the sense of this Association against any tampering by Congress with the oleomargarine law passed at the last session of Congress.

THE GENERAL PURPOSE COW.

By JOSEPH THORNTON, *Girard, Pa.*

The subject of cattle growing is one that is enlisting the attention of the best minds in the country. Each year the subject is becoming better understood. Valuable improvements are being made in our cattle herds

It is not my purpose at this time to enter upon the general subject of cattle breeding, except so far as it is necessary to present my views of a general purpose cow.

I know of no branch of the subject of cattle growing that more generally effects the masses of people than the question of the requisites of a cow that is best adapted for general purposes.

Milk and beef are the chief objects to be attained; an animal that does not combine these two primary elements is not a general purpose cow. The possession of either of these qualities without the other does not fill the requirements.

A general purpose cow must be such as to meet the requirements of the greatest number of people. The wants of the people are varied in this respect, and you cannot, in the full sense, meet the varied wants of all by any individual animal.

Some want milk, some butter, some cheese, some beef, some want all from the same animal.

For the purpose of milk, butter and cheese, we want quantity and quality. For the purpose of beef we want size and quality. These elements must all be conceded to be essential to the general purpose animal; and while such a cow may not specially excel in any of

these requirements, she must fairly meet them all. I maintain as the result of more that twenty years of experience and observation as a breeder that such an animal can be produced by judicious and proper breeding. I have no hesitation in saying that a large class of breeders have hitherto given too little attention to the important feature of the subject of breeding. Too many of our breeders are what I call specialists, some breeding specially for the beef qualities and ignore the milking qualities; others breed more specially for the milking qualities and disregard the beef qualities; both are wrong. Neither course will, or can, produce the best general result. In neither way can you produce a desirable general purpose animal.

Intelligent breeding requires close attention to both milk and beef qualities, and these should be sought in both sire and dam. The milking qualities of a cow must be considered with reference to quality and quantity of the production.

Some cows produce a large quantity of milk that is comparatively valueless in quality; others produce milk of fine quality but of small quantity. Such animals might answer the purpose of some people, but would not meet with favor from the general public.

I want a cow that produces a good quantity of a good quality of milk, which I can use for general purposes. I want good flavored milk for use in the family. I want at the same time a quality of milk that will produce a liberal amount of a good quality of butter and cheese.

Milk of different cows varies as much in quality as it does in quantity; this is demonstrated not only by a difference in the butter and cheese made from it, but by its effects in family use and upon the offspring of the animal. It is an actual fact that the milk of some cows is wholly unfit for children and cannot be used for them. The milk of some cows is poisonous to their own calves, and they die from the effects of it, yet the milk of these cows may be and generally is good for cream and butter.

I want a quality of milk that is adapted to the general needs, and I don't want a cow that don't produce it and in paying quantities. I don't want a cow that won't raise well one calf, I want a cow that will raise two calves well.

I would say that a general purpose cow ought to give from forty to fifty pounds of good milk per day in height of milking season upon good feed, and many will do more.

That she ought to give milk for at least ten months of the year. Some cows will milk for a longer period, but I am opposed to allowing them to do so on general principle, with the milk quality I insist that we should combine beef qualities.

When a cow is no longer useful for milk, then let us have a cow of size and form that will respond to feed, and when fattened for beef weigh on foot from fourteen hundred to sixteen hundred pounds.

An animal that when killed furnishes a quality of beef fit for the table of any one. I want a cow that will readily fatten when dry, with reasonable feeding; a cow that will not do this is not fit to be called a general purpose cow.

For a general purpose cow I maintain that a thoroughbred is the best, and for that purpose I would not recommend the breeding of any other, although I do not say that good results may not be reached in some instances by the breeding of grades. What I mean is that the best general results will be attained by breeding thoroughbreds. As

to what particular breed is best adapted for the development of general purpose cows, I am aware there is a wide difference of opinion. Each breeder will assert that the breed that he is engaged is the best. I concede the right of every one to maintain, if they can, that their favorite breed is the best.

There are many breeds of cattle well adapted to specific purposes and which I greatly admire when properly bred.

Nearly all of the improved breeds are valued for some particular purpose. There are some of them well adapted to general purposes. This class is the most valuable. therefore, when you begin to breed you must determine whether you want to breed for general or specific purposes and breed accordingly. If you desire to breed for general purposes the question arises, what breed shall we take?

I would say take the Shorthorn, as the history of this breed of cattle demonstrates that they are the best general purpose animal grown.

That they are the best adapted to the general wants of the masses. They are good breeders, large and symmetrical in proportions, good for milk and butter, and second to no breed in the world for beef. They are hardy and will adapt themselves to our diversity of soil and climate better, in my judgment, than any other breed.

The Shorthorn is the oldest breed of cattle of which we have a straight lineage. The Shorthorn is, not only in my view of the case, when properly bred, the best pure bred animal known, but when crossed with other breeds invariably transmits their characteristics to the offspring. I have failed to find any other breed on which I can depend with as much certainty in this respect.

Every careful observer of grade Shorthorns will concede the truth of this proposition.

This fact makes the Shorthorn very valuable as a means of improving other breeds in beef and milking qualities, and make them, as a breed, generally sought for by intelligent cattle breeders for that purpose. You can scarcely find a herd of cows kept for milk and butter purposes that does not contain a number of either pure bred or grade Shorthorns and the Shorthorns are generally rated by the owner as the most valuable of the herd. This affords a reason why so many are desirous of obtaining thoroughbred Shorthorn bulls for the purpose of crossing with other breeds. In fact experience clearly shows the Shorthorn to be the best of all breeds for crossing purposes.

There are so many valuable families of pure bred Shorthorn, that it is impossible in this connection to do justice to them all. I shall therefore confine myself to the justly celebrated "Princess Family," that family being in my opinion the best adapted to general purposes of them all. I express this opinion well aware that many intelligent and successful breeders and admirers of the Shorthorn will take issue with me, but it will only demonstrate that we don't all think alike.

We learn from what seems to be reliable authority that this noble family originated from a cow bred by Mr. Stephenson, of Ketton, England, in the year 1739.

This is undoubtedly the oldest Shorthorn cow capable of being traced as the foundation dam of any tribe of which a record in unbroken line has been preserved.

This family was introduced into the United States about the year 1850. They were first introduced into the eastern States where their superior milking qualities were highly valued, and where they have been bred pure to a limited extent.

It is only a comparatively late period since they were introduced in the west where they are rapidly growing in favor and where they are developing desirable beef qualities as well as maintaining their milking qualities.

Much more might be said of this noted family but time will hardly permit of speaking more at length at this time.

In conclusion I would say that for a general purpose cow, one that possesses in an eminent degree all the general qualities desired in such a cow there is none that successfully compete with a Princess Shorthorn.

Discussion.

Mr. PHELPS believes the day is past when the general purpose animal of any kind is to be had. We are in age when specific purpose is the aim. The general purpose cow is too much like the old time way of travel. We have left the stage coach and the canal boat behind, and with them the age of the general purpose cow or horse. As well try to make a trotting horse of a Clydesdale as a good butter and cheese cow of a beef breed. We have a special calling for each animal and should try to make each class supply the wants of its calling.

A MEMBER. We cannot all be specific purpose men, many of us must devote our efforts to general purposes, hence we want general purpose animals.

Mr. SPITLER asked if the general purpose cows give milk that kills calves. No answer.

Mr. FAIRWEATHER don't believe there is such an animal as the general purpose cow; if she excels in one respect she fails in others. We are in a specific age. We want one breed for butter, another for cheese, another beef. Don't believe the general purpose cow, even on a modified scale, can be found in the throughbreds. She must be a cross. Do not believe in the assertion that milk which will kill a calf will make good butter and cheese. It is well known that any deleterious element in milk goes more largely into the butter or cheese produced from that milk.

SILO AND ENSILAGE.

By J. B. PHELPS, *Conneautville*, *Pa.*

Mr. Presideut: In giving my experience with ensilage I can but reiterate the experience of many others. Those who have read much of the agricultural literature of these times have noticed a marked similarity in the process of handling ensilage and experience reported in handling it.

True, there have been changes and improvements made every year, and to-day we find that the handling, storing and feeding of ensilage is done far different from what it was when it was first introduced into the United States some ten years ago. Then it was thought it required costly silos built with masonry, filled with great speed, much help and expense, weighted with ponderous heft, and when taken out was found to be too strong with acid, and was sought to be fed as a perfect feed.

Now the silo is built of cheap lumber, above ground, and filled by

the ordinary farm help, with no rush or hurry, weighted with a covering of dirt or sawdust, or wild-grass hay and when taken out the silage is found to be sweet and is feed in connection with other feed. So much for improvement.

At the October meeting of the State Board of Agriculture, held at Conneautville, last fall, the committee on grasses and forage crops reported that silos had been tried and found not satisfactory. The report sounded to me some as I often hear men talk who know but little about the subject they are treating.

In 1880 there were six silos in the United States. In 1885 there were nearly 2,000, and the number is rapidly increasing. In England there were four silos in 1880; in 1884, 600; in 1885, 1,183 by actual count. These figures seem to indicate satisfaction somewhere.

After reading all I could about ensilage, the report from the ensilage congress and good men's experience in the matter, and hearing all the arguments, pro and con, I concluded to build a silo, and now comes my experience in the matter:

Building the Silo.

The side of my bank barn stands to the bank. The silo is at one corner, extends along the side of the barn twenty feet and is dug back into the bank twelve feet, giving me ten and a half by seventeen feet inside measurement, it is walled with stone on three sides nine feet high. On this wall is a timber frame ten feet high, covered with a roof in connection with the barn. On this wall I sat up studding, inside of frame, and ceiled it up on studding with first quality, well seasoned and matched maple lumber, nine feet high, making my silo eighteen feet deep. The side next to my cows is also ceiled up from bottom to top. After I ceiled it I gave it a good coat of iron ore paint. The walls and bottom are plastered with cement, care being taken that the sides should be smooth and even.

Growing the Silo Filling.

The silo being built, the next thing to consider is to fill it, I took four acres of the poorest ground I have on my farm, gave it a good coat of manure; plowed it under, fitted it in good shape for planting and drilled in one-half bushel to the acre of Burrell & Whitman's ensilage fodder corn, with a good sprinkling of Buffalo phosphate, in rows three and one-half feet apart, rows running north and south. It was put in about the middle of May. After drilling I rolled the ground. After the corn got up two or three inches I tried the harrow (as per directions came with the corn). The corn looked thin for fodder, the harrow tore up some and I got disgusted with it and sent it to the barn and hoed the balance the old way.

The corn grew very fast and attained immense growth. I watched it with great interest, until the first of October. I awoke one morning and found it white with frost. That night at five o'clock my corn was all cut and in gavels, and the next day was set up in large shocks that would weigh one thousand pounds each. I then commenced drawing in; cutting it with a power Swiss feed cutter in lengths one-half inch long, with a carrier attached conveying the fodder into the pits. In filling my silos I put a partition in the center making two pits. I filled into one one day, the other the next, taking our time for it so as to give each time to heat before filling in again.

Sealing the Silo.

After filling the silos I let them stand one day, and then leveled them off, covered with tarred building paper, then two thicknesses of inch boards, breaking joints, then covered with six inches of moist clay well tramped down and tramped down every day around the edges as it settled.

I opened one silo on the 26th of November, found some mould about the edge, but not bad; cows ate it all readily. The silage was slightly acid. After eating it a few days the cows would leave the best of hay and take silage.

Feeding the Silage.

I fed my cows each thirty pounds of silage and one and a-half pounds of wheat bran in the morning. At night I feed to each fifteen pounds of hay. Upon this feed the cows increased their milk, and I found it quite difficult to dry them off. One pit, or one-half I raised, kept twenty two cows and one yearling fifty days with this manner of feeding. I am feeding the other pit now and in addition to the bran have added three and a-half pounds of corn meal to each of my six new milch cows. They are milking splendid, better by far than I ever knew them; are in good order and seem to be doing well.

Mistakes Made.

I will now tell you of my mistakes in my experience:

First. I should have drilled my corn earlier, as I could have done so by two weeks. Get the corn in as early as you can.

Second. I should have harrowed the corn instead of hoeing it the first time, as I would thus save two thirds the labor and the corn would have done just as well.

Third. I should not have tamped the fodder when filling in the silo, as tamping retards the heating process, and causes the silage to be acid.

Looking at the Benefits.

In summing up my experience, the all-important question now is, what benefits do I derive from ensilage? I answer, it has resolved itself into a mathematical problem. As I stated before, I have been feeding this winter thirty pounds ensilage, one and a half pound of wheat bran against fifteen pounds of hay. As hay is worth ten dollars per ton or one-half cent per pound, I fed each day seven and a-half cents worth of hay to each cow. Bran cost me fourteen dollars per ton, therefore, I fed of bran one cent's worth per day. If ensilage is worth two dollars per ton, I fed three cent's worth of that to each cow. Now three cents worth of ensilage and one cent's worth of bran against seven and a-half cents worth of hay, makes ensilage nearly as cheap again as hay. Again, if one acre will yield twenty tons of ensilage (which I think can be done easily) then one acre of ensilage and fourteen dollars' worth of bran is equal to ten tons of hay, or what would be five acres of very good hay.

These facts staring us in the face, wont we have to yield to the idea, that ensilage is the cheapest feed and the most economic when fed in connection with other feed?

The time is coming, in my opinion, and not very far hence, when silos will be as numerous as haymows, and a person will not be called

much of a farmer if he cannot keep a cow the year round on two acres of ground.

Mr. President, I have tried to give a very plain statement of my experience with ensilage and if any member of this association can "catch on" to and be benefited by anything I have said, I shall feel myself a public benefactor to help analyze new ideas that may come before progressive farming.

FARMERS' HOMES.

[Synopsis of lecture by Joseph Beatty Powell (Shadeland), Springboro', Pa.]

Mr. Powell commenced by quoting from Ruskin, where he recommends his readers to careful consideration of what they read, especially that which displeases them.

This world gives much for entertainment and but little for improvement. The surroundings in the country are so changed from those in town that what is necessary to a home is very different. Farming, as a rule, only brings in from two to four per cent. on the investment of the farmer. Those who pay a high rate of interest must sooner or later become insolvent. An eccentric man in Western Crawford built a house, consulted everybody and built as he pleased. The one gratifying thing about it was when done it was paid for. We want judgment, consistency and individuality, considering the surroundings.

As the country progresses the people are coming closer together. A few years ago only the wealthy few could have any of earth's luxuries; now the daily paper and many other luxuries reach the farmers of the country. The day may be near at hand when the government will even distribute letters and other mail to farmers in thickly populated sections.

One of the chief delights of Daniel Webster was to spend a portion of his time on his farm. William M. Evarts, one of the greatest men of this country, enjoys his vacations from public services on his Vermont farm. Thoughtful men delight to have a big spot of ground to call their own.

In the New England States, and in some parts of the West, they have organized what they call village improvement societies, which are doing much to improve and beautify farmers' homes, by improving roads and all external appearances.

The first principal of a good farm home is a good farm of fertile land. Those slopes of land where the sun strikes first in the morning are the most valuable. The best frontage of a house is the south-east. If you build a bank barn, don't have it open to the north-west; to the south east, or as nearly so as possible, is highly preferable. Homes should be built for adversity rather than for days of prosperity. In the flush of health and vigor one can endure much. In old age and sickness the most cheerful comforts of home are wanted. Build them for such times.

Near the great cities broad lawns are desirable, but the farm-house should not be far back from the highway. When far back they conduce to loneliness which often leads to insanity on the part of their constant occupants. The average country house should be from five to ten rods back from the highway. We want to associate with our

neighbors as much as possible, thus creating cheerfulness for each other. There are objections to building too close together, but we must take the world as we find it, bear with each other and thus benefit all. The American people will go to great expense to gratify stomach or fancy, but at once rebel at the intimation that they do not know everything.

No doctor can afford to be his own physician, no attorney his own lawyer, and no one contemplating building can afford to be his own architect. The Norman style of architecture, says a leading architect, is coming into use in this country. Eastlake says beware of the latest fashions in building homes. You are building them for life. Do not copy a rage. Look rather to utility than to beauty. Let art adorn but not govern the household.

Different parts of the country require different styles of buildings. Climate and other natural conditions should largely govern. One of the worst faults with many farmers' homes is that changes of climate are not taken into consideration. The kitchen is too often so arranged that with the coming of warm weather moving begins and continues till the backyard is reached, as the weather may suggest. The kitchen should be constructed for both winter and summer.

Don't build too large. If any room is to be left out let it be the parlor. Let the sitting or living room be right in the south-east corner—the pleasantest spot of all. Live in the most pleasant part of the house. Don't sneak into the back door, or live in the back room where there are no cheer and comforts. Live where the most comforts are. A great many of the fashionable ideas are all moonshine. Draperies hung about rooms gather dust and are unhealthy.

The farmer's chief building is his house. Don't put an iron fence around a frame house. Yard fences are passing away. Build moderately, conveniently, handsomely, but don't sacrifice convenience to art. Build convenient hallways and easy flights of stairs. In this climate a cellar is essential. It should be plastered overhead to insure healthfulness; good flues should be constructed from the cellar up the chimneys to carry off the fumes of vegetables stored in the cellar. Don't build on a clay bed. Get a good gravelly site. Prepare tile sewers to carry off all slops, and avoid disease germs.

In warm climes flat roofs and high ceilings are preferable. In cold climes steep roofs and lower ceilings are better adapted. The average farmer cannot afford hot furnace air or steam heat. The old-time fire place affords good ventilation. Modern skill has invented many devices for ventilation which are superior to it for producing both heat and ventilation without creating cold drafts.

The lawns should be supplied with ornamental trees, and the stock buildings should be at the rear, not across the highway.

In painting country homes don't run after somber colors because they are the rage. White is most cheerful, and is always in fashion.

There should be sidewalks from house to house along the highways. They add to convenience and happiness.

Of all the important features of the farmer's home, the chief one is, after all, the sons and daughters who must supply the places of the true nobility which is passing away with the changes of time, and must be supplied from the country home. City life is not conducive of the true stability needed.

The country schools should be better graded, the boys educated for the occupations they are expected to follow, in the industries as well

as in the arts and sciences. They should have male teachers. The girls should be educated for the specialties of their lives Better of all would be systematic hauling of children to town in spring wagons and there let the classes be properly graded, with special teachers for the various grades.

Don't court shams. Do not paint the front of the house and leave the rear unpainted. Do not buy shoddy articles of any kind. The best is the cheapest in the end.

In building his home a man should provide for adversity. Guard against accidents which may bring adversity, such as imperfect flues. Ordinary brick chimneys are not safe. In a few years of use mortar falls from the crevices and smoke and sparks come out. Matches are a cause of many fires. They should never be carried loose in the pockets.

To guard against lightning a good iron rod is all that is needed. It is the body of the iron which conducts lightning, the finish has nothing to do with the usefulness of the rod. The ornaments are only for show, and to catch fabulous prices from those who have money to spend.

IMPURITIES IN MILK.

By WILLIAM FAIRWEATHER, *Meadville, Pa.*

Milk is a most complex compound and a substance about which we know very little. Its component parts can be determined to a considerable extent by analysis, but its production and variations of quality are subjects into which the more we study and inquire the more we are bewildered and benighted.

So experienced a professor as Dr. Sturtevant declared before the New York Dairyman's Association that four years of incessant study of milk at the New York State experiment station, with almost constantly contradictory results, had convinced him than he knew less about milk than he formerly supposed he did.

The question which first requires our attention is the composition of milk. What is it? The chemical composition of milk varies considerably in different cows in different herds, and still more according to the manner in which cows are fed, but a fair average might be given as follows:

Water,	87.25 per cent.
Butter,	3.50 per cent.
Caseine,	3.50 per cent.
Albumen,	.40 yer cent.
Milk sugar,	4.60 per cent.
Ash,	.75 per cent.

Thus it will be seen that milk is a perfect food and contains all the elements of nutrition required for the growth, development and sustenance of the human body.

The composition of milk depends in a great measure on food, season of the year, length of period that the cow has been in milk, and last, though not least, on breed. There has been an erroneous idea among dairymen that by feeding special foods, say foods rich in carbon, for instance, the milk would run to fat and produce more butter proportionately. This is not the case. By special foods we increase the total solids, but the proportion of fat to caseine will be just the same as on ordinary diet.

Under the microscope milk is seen to be a fluid in which float countless numbers of little globules, these contain the butter fat. Authorities differ as to the structural formation of these globules. By some it is believed that they are enclosed in capsules or sacs and that the friction of churning breaks them and liberates the butter oil or fat. Others maintain that there is no covering on the globules and that the watery portion of the milk keeps them apart in the same manner as oil separates into small particles or globules when thrown into water. Analysts and microscopists are familiar with the fact that the milk of different breeds presents a varying appearance as to composition and quality. The Jersey has the largest globules of any breed and is on that account noted for its butter-producing qualities. The cream of such milk will also come to the top quicker than others. The Ayrshire has a smaller globule and is therefore better adapted for family use, as the cream does not rise so fast and even when risen it can, by agitation, be again easily mixed with the milk. which renders it more suitable for table use.

The secret of how a cow produces milk is something which "bossie" has not yet been induced to impart to civilized and enlightened men. It has generally been believed that the cow keeps industriously manufacturing milk all day and stores it away in receptacles provided for that purpose, so that she may be ready when driven up at milking time to do her duty towards her owner. Against this theory we are confronted with the fact that the cow with the largest bag sometimes gives only a moderate yield of milk, while the one with the small bag fills the pail. This has led to the theory that probably the cow manufactures the milk to a considerable extent while she is being milked. Professor Ballantyne says many animals have no milk reservoirs, the lactiferous duct being connected directly with the milk vescicles so that no considerable amount of milk can be carried ready formed. Such he says is the case with the human female, and the larger portion of the milk must be secreted while the child is at the breast. Directly how the milk is produced we do not know, but it is supposed to have a very close connection with the blood of the animal.

The influence of food on milk is a subject of great importance and one which has not been sufficiently studied by the dairy farmer.

A milch cow requires a certain amount of food for the support of life; what she eats beyond that amount goes to make either milk or flesh, and for the maintenance of health the food which she consumes must be properly proportioned to the wants and wastes of her system.

It is estimated that three pounds of a good quality of hay per hundred pounds of animal contains the right quantity of nutriment necessary for her maintenance, that is, it will keep her alive and in good health without increasing her weight. The best meadow hay has a nutritive ratio of one part of nitrogenous matter, to five of carbonaceous matter, which is about the right proportions for a complete food.

It is a mistake to suppose that feeding a food rich in fats or carbohydrates is the best way to get rich milk. These substances are utilized by the animal more for the purpose of fuel than otherwise.

With them she keeps up the animal heat and, largely fed on such matter, the extra quantity and richness of the milk is not so much due to their direct action as the assistance they afford the protein in preserving it from waste. The richness of the milk is derived from the albuminoids or nitrogenous matter in the food consumed.

To keep a cow in perfect health she must be fed judiciously, that is, the nitrogenous and non-nitrogenous elements must bear a certain proportion to one another. When the nitrogenous food is given in excess it is liable to produce disease in the animal by unbalancing her system. It may produce garget and other inflammatory diseases. Distillery slop is a substance that besides having other unsavory qualities has protein largely in excess, and its carbo-hydrates consist largely of alcohol. It is, therefore, a food totally unfit for milch cows, upon which it produces an injurious effect, rendering them liable to various wasting diseases and making their milk unfit for human food.

Some time ago there was a discussion among the scientific men in France about the healthfulness of feeding brewers' grains to cows. M. Toussaint, a great authority on such matters, maintained that milk produced from such a substance might show by analysis no great variation from other milk, and still be indigestible. He had examined the death records of Argenteuil and ascertained that affections were more frequent from bottle-fed children since a large distillery had been established there. "Milk," he said, "from cows to which the malt refuse from the distillery is given is acid, and is not digested by children. The milk of cows fed on brewers' grains is milk which results from an artificial kind of alimentation, and in consequence is an artificial milk which loses some of its most desirable qualities." The milk then of cows fed upon brewers' grains is a bad quality of milk, which it is absolutely necessary to reject in the feeding of infants of a tender age.

Careful experiments have also proved that cows fed on brewers' grains not only become in a short time phthisical and give a much larger quantity of milk than was usual, but that the milk was watery and non-nutritious, and probably productive of consumption in man, and certainly unwholesome. The standard quality of milk as regulated in the city of Boston, contains thirteen per cent. of solids, that is, a dairyman who offers for sale a milk containing less that thirteen per cent. of solids is liable to a fine. Milk from the Ayrshire Dairy, of this city, by analysis, showed 14.77 per cent. of solids. Milk from brewers' grains will average ten per cent. of solids. Swill milk will average but nine per cent. Thus if we take the Boston legal milk as a standard, at six cents a quart, milk with 14.77 per cent. of solids would be worth six and one-half cents a quart. Milk from brewers' grains, with ten per cent. of solids, would be worth four and one-half cents a quart. Swill milk, with nine per cent. of solids, would be worth but four cents a quart. The value of milk is just the value of the nutritive matter it contains, and this matter is all contained in the solids. It is a notable fact that whatever cows take into their stomachs, the qualities thereof, whether for good or for evil, will be diffused throughout the milk. The mammary gland is particularly disposed to be acted on by all noxious or innutritious substances consumed by the cow.

The milk acting as a receiver of such objectionable matter, and at the same time a channel through which it may pass from the body.

It must therefore be seen that it is of the highest necessity to feed cows giving milk with the utmost care, and that not only should we give them the best quality of food, but that such food should be in a ratio carefully balanced as to its component parts to preserve the highest state of health in the animal. This is the only way to insure a healthy and nutritious flow of milk.

These are matters which are of the greatest importance to the dairyman, whose business it is to supply, and to the consumer, whose business it ought to be to see that he is supplied with a pure article of milk.

It is a well-known fact to physicians that nursing mothers often make irritable and even convey disease to their children by unduly yielding to their appetites in foods which at that period it is unsafe to eat, and while the mother may be able to withstand the unwholesome fare, its bad effects are conveyed through the blood into the milk, and from thence into the tender stomach of the child, which it injuriously affects, sometimes only temporarily, yet often seriously. To illustrate: A family who had eaten of poisoned mushrooms all died but one, and this one was the mother, who was nursing an infant. The infant died from the poisonous effects of the milk of the mother, but the latter escaped with but slight sickness.

Nero, the Roman emperor, whose life was a continued series of drunkenness and debaucheries is said to have acquired the taste for strong drink when a child through the influence of the milk of a drunken nurse. Now, if the baneful habit of intoxication can be implanted in a child through the medium of a nurse who occasionally indulges in strong drink, how much more so will it be likely to take root in children fed on milk from cows whose daily feed is the alcoholic refuse of malt liquors. Yet the consumers of milk have taken so little interest in this subject that there is only one State (New Jersey) that has prohibited by law the selling of milk from cows fed on the refuse of malt liquors. And as it has been shown that such feed is a frequent cause of tuberculosis in cows, and that this disease can be transmitted through the milk to the human species, we see the necessity for legislation on the subject.

There are other causes besides change of food that will influence milk. It is probably not generally known to what a great extent the percentage of cream may be reduced by any excitement or worry caused to the cow.

On this subject Dr. Sturtevant says: "Under the same feed and under the same circumstances the same cow gave nine and a half per cent. of cream. and another day eighteen per cent. of cream." And, Mr. Lewis, an old experienced dairyman tells a still bigger story. He says: "I have taken a good deal of pains to test the value of my milk that I have worked into cheese. I have graduated glasses for the purpose and I have found a cow whose uniform average for cream was eighteen per cent. reduced to six per cent. in twelve hours, not from any change of food but from a little excitement. You gentlemen, who make butter be careful to adopt my advice and always treat your cow kindly and gently, never get her excited because every ounce of excitement will take from her milk one per cent. of cream. I have known a cow abused by a furious, brutal milker and her per cent. of cream went down one-half. It is astonishing what an effect excitement has on the percentage of cream in the milk a cow produces. I have known a cow excited from natural causes to drop in her percentage of cream in her milk from fourteen to six per cent. in twelve hours. So I would again repeat, whoever abuses his cow knocks out of his milk a large per cent. of cream."

It will readily be seen how important it is to keep the cows quiet from fright and all excitement. The worrying of dogs, the hurrying and hallooing of boys driving the cows home from pasture, the kick-

ing and pounding by an angry milker or any similar cause of excitement will be sure to reduce the quality of the milk to the extent of several per cent. of cream. This fact is too well attested by many careful and experienced dairymen to admit of a doubt, and the first object of concern with the butter dairyman especially, should be to see that his cows are treated with the utmost gentleness all the time. The boys who drive the cows home will make a note of this and when the spring comes and the cows go out just mark what we say.

To sum up, there are many causes which exert an influence on the milk and all the most careful dairymen can do is to keep his cows in as healthy a condition as he can by feeding a suitable and nutritious ration, proper attention to stabling, watering and milking, and the keeping of his cows as free from excitement and worry as the circumstances will permit.

ELECTION OF OFFICERS.

The election of officers resulted as follows:

President—J. B. Phelps, Conneautville
Secretary—R. H. Odell.
Treasurer—W. W. Dean, Meadville.

The meeting continued with much interest until four o'clock Thursday afternoon, when the Association adjourned to meet at Springboro', Wednesday, May 4th.

SPRING MEETING.

Held at Springboro', Pa., Wednesday, May 4, 1887.

ADDRESS BY PRESIDENT J. B. PHELPS.

Mr. President and Gentlemen of the Association: In accordance with the customs of my predecessors in office, I am called upon to deliver the opening address of this meeting, and as this is my first attempt I design to be brief.

I congratulate the dairymen of this Association for the very flattering outlook of the dairy interest at the present time, especially of cheese. I can see no reason why that product will not bring a satisfactory price the coming season. The market is booming, with small stocks on hand. And with the enforcement of the bogus butter laws, which are being done all over the country, I cannot see why it will not enhance the price of butter. This being the case, should we not increase our product both in quantity and quality, that we may gain by the situation, and right here we have met to-day to derive this information.

It is thought by many farmers that this association amounts to nothing of any good to them. That too much theory has been used, and too little practice preached. Perhaps this is true to some extent, but you are doubtless aware that theory and practice must train together. I am very positive that this Association has been advantageous, and an improvement to this country. We have been directly benefited by it. This I will try to prove. When this Association was in its early days, salesmen of cheese would have been glad to have gotten into the eastern market for their goods within one cent of highest quotations. Now we sell our goods in the same markets from one-fourth to three-fourths of a cent above the highest quotations, and cannot make them fast enough to supply the demand. I must say, however, these prices are obtained by men who have most always attended this Association, and watched closely its proceedings, whilst their unfortunate brethren in the business, who stayed at home and spoke derisively of us, have to take seats in the background in prices, and are wondering how such prices are obtained.

The same rule applies to the manufacture and sale of butter with the same results, and had it not been for the dairymen's associations that exists in most every State in the Union. the bogus butter law that now is in force, and we think will prove a great blessing, would have never been, and the price of dairy goods to-day would not be where they are. These are arguments I think that are pertinent to every thinker, that we must organize ourselves and study our interest, that we may excel. Again, most all industrial pursuits now have their organizations, and for that reason I attribute the great progress that is being made in the world.

The progress of the age is a theme that we are here to study, especially in our calling, and we should not pass it by with indifference. Progress is marching on at a quickstep pace, and the farmer that don't keep step to the music, and keep up with the procession, is going to be left behind.

We that are middle-aged and past know we cannot farm now the same way we did three or four decades ago. Our soils have lost their native fertility through bad management. The time was when it was thought that most any one could be a farmer. Now farming is reduced to a science and that the farmer that don't use science in his calling might as well quit the business or he will sooner or later succumb to the county house. Let us notice how some of our modern farmers manage. We step into their stables and find their cows giving from two or three thousand pounds of milk during the factory season making from fifteen to twenty dollars per head, when we know it costs that to keep them, and some times more. We turn our attention to stock raising and making beef a while. We sell our beef for three or four cents when we know by the report of the fat stock show, where the cattle are feed scientifically too, that it costs four and five cent. per pound. This manner of farming will not pay and it is no wonder that we hear so many farmers saying of late years that farming don't pay. All of these things must be changed. We cannot get very large prices for our goods, but we must *produce them at a less cost, and in greater quantity.* We must bring our farms up in fertility and improvements from thirty and fifty dollars per acre to seventy-five to one hundred. This can be done.

We must bring our cows up in production of milk to five thousand and seven thousand pounds of milk per year. This can be done through breeding and handling. They can be kept in better condition than what they generally are to-day for less than one-half of the expense, thereby doubling our profits.

All of these are brought about by progressive farming and right here, in this Association, is the place to learn it, in disseminating of knowledge and interchange of thought.

One great hindrance to progress in our associations is the timidity and backwardness of its members in advancement of ideas of practical importance. As a general thing, ideas expressed by practical farmers, though roughly spoken, carry more force and is quicker grasped than when expressed from a theoretical standpoint. This timidity should be overcome. We are associated together as dairymen and we want the experience and close observation of such in our councils.

Gentlemen, I have presented to you some plain ideas and suggestions, and believe, if practically carried out, we will have an interesting meeting.

WELCOMING ADDRESS.

By L. F. McLAUGHLIN, *Springboro', Pa.*

Mr. President and Gentlemen of the Pennsylvania State Dairymen's Association: I appear before you in the name and in behalf of the citizens and farmers of Springboro' and vicinity.

Many years before the Christian era, a monarch of the great Lydian empire was called upon by one of the wise men of Greece, and, as a counfelor of high order he welcomed him with great pomp and display; setting before him the best of his household and extending to him the freedom of his province. This, that he might learn from his wisdom and be benefited by his counsel. As heartily, as earnestly

and as hopefully, do we extend to you, the solon's of agriculture and of the dairy, a welcome.

The freedom of our beautiful borough and the hospitality of our homes are yours. Yours not only in your present capacity as members of the Pennsylvania State Dairymen's Association, but as intelligent men representing as you do a vocation which is of itself honorable, pleasant and independent.

We know that when the agricultural and dairy interests prosper the whole nation prospers. We know too when individual members of a community prosper in pursuance of an honorable calling the community likewise prospers.

We realize how closely the best interests of our government are allied with those of the agricultural interests generally and we feel it is our duty as an intelligent people to foster and encourage the tiller of the soil and the herdsman with his flocks. We believe that in you and in your calling are the elements of the success of ourselves and of us as a nation. We believe that in your action and in your council you will encourage the farmer to a more thorough, a more scientific knowledge of his honorable vocation.

The field of your labor is yet a broad one; it is responsible, it is exhaustless, and while you undoubtedly feel you have much yet to learn, we doubt not that your words of wisdom may be as lasting, as important, as impressive as was those of the great solon of ancient fame.

In looking over your labors covering a period of years, the time of the existence of your organization, we notice much of importance you have accomplished and much of good you have done. The benefit of your organization, the advantage it is to our most important department of labor is apparent to the most casual observer at all times.

This, the nineteenth, century is a great and grand one, to live in this age is a great favor when compared with periods gone by. The advancement made in the arts, sciences, discoveries and experiments is truly great and marvelous. The facilites and improvements, wonderful machinery, telegraphy, in telegraphing our speech itself. The improved manners of heating—and if we are to have the heating apparatus and principle of heating the whole world revolutionized, as seems to be indicated by experiments and discoveries recently developed at our county seat, then we again say marvelous! marvelous! and are we to be behind in agriculture dairying, &c.

We say no, and to you and upon your organization much depends to keep apace with other things around us.

In your line the development of a Mary-Ann of St. Sambut, a Princess Second of Baltimore, a Mercides in their wonderful milk and butter records show the rapid strides you are making, and perhaps a more thorough knowledge of agricultural chemistry, or of chemistry alone, may develop the lacteal fluid or, the wholesome butter and cheese as marvelously and as economically as the many other wonders of this age. I am not here to boast nor would my fellow-citizens bear me in much egotism, but it is due to us to say that while our section does not outrival and lead all other sections in all improvements, advancements, experiments and success in the line of farming, dairying and manufacturing yet there are some things we may be allowed to point to with assurance, which does not leave us entirely undistinguished as a part of the great Commonwealth of Pennsylvania. We have here among us breeders of the pure bred cattle, the Devon, the

Durham and the Holstein, and they make no mean advancement in perfecting their several breeds.

"Of the talents given them none do they bury" nor, do they hide their light under a bushel. One of our enterprising breeders of the Holstein boasts of a milk record of a two-year old cow that is yet to be beaten. The intricate ways of the keeper of the Devon H. B. is overcome by the earnest effort and correct breeding of that class of beautiful cattle, and the majestic and dignified Shorthorn, improving each year's grazers on our hill and in our valleys to the admiration of all. Jacob, in the aggregation of his herd from the ranch of Laban, was not more fastidious in his breeding for good results, than are our breeders in their efforts and desire for the improvement and advancement of their herds. So noted have they become that from many parts of our nation, enterprising men come and select, that their herds in turn may be in the front rank.

Here too are found establishments for breeding and improving the running, the trotting and the draft horse, and among them are represented the best strains of blood in their several classes known to the world.

As a county we lead the van in the dairy interest, having more cows, more cheese factories, and make more and better cheese, and of a higher grade, than do any other two counties in our State. The pioneer factories were built in this county, and in our little borough was built some twenty years ago the second factory erected in this State.

I can hardly bring these remarks to a close gentleman, without calling your attention to some obstacles in the way of general advancement, improvement and participation in the benefits of pure blooded stock, and they come by the usual way—of grasping monopolies, claiming to be public.

In a meeting of this association held here at Springboro' in March, 1880. One of our farmers, who was I suppose a member, said "the reason why we make so little progress, is that we have to pay too high prices for our pure blooded stock to start with." This fact remains the same to-day.

It is said "that he who causes two blades of grass to grow where only one formerly grew is a public benefactor." It is not expected that the small increase is of itself the blessing, but that the principle involved is the valuable part. That he who assists "bounteous nature" so that the production of vegetation is increased without a corresponding outlay, expense or space discovers a feature or establishes a principle which is a blessing to mankind. The man who breeds to increase the flow of milk and accomplishes it, who demonstrates to us how to improve the quality and quantity of our beef, who breeds to increase the speed or draft of horses and succeeds and gives to the world the results of his experiments and secret of his success is the man who accomplishes great good to his fellow man, and future generations will rise up and call him blessed.

For no purpose could be grander nor more in accordance with the commandments.

But what shall we say of him who develops the marvelous milk and butter records by "ways that are dark and tricks that are vain" and places such values upon his cattle as to exclude the common man from the enjoyment of his discovery, or develops a Maud S. or George Wilkes with their great rate of speed and so manipulates their produce

and service as to place them beyond the reach of the common enterprising breeder.

There was a grand spectacle at the capitol of our State this winter in which we saw the assembled masses fighting that grasping monopoly that sought to corral one of Pennsylvania's greatest interests. And a grander sight still was to see an organization, having for its object the advancement and elevation of the laboring man, assembled near our hall of legislation inspecting closely and passing with deliberation upon all prospective laws affecting the standing and welfare of such a numerous and unprotected population. Might we not with propriety call the attention of this organization with a view of correcting the many abuses, deceptions and frauds to which the common farmer is subjected to in the way of prices, pedigrees, machinery, &c. And may we not say that upon you gentlemen of the Pennsylvania State Dairymen's Association, rest many grave responsibilities, and upon your wisdom and intelligence the future of the interests you represent largely depend.

But, gentlemen, I have already trespassed too long upon your valuable time. Let me again say we are glad to welcome you among us.

May your session here be pleasant and long remembered.

AMERICAN AND ENGLISH CHEESE AND CHEESEMAKING COMPARED.

By Prof. L. B. ARNOLD.

In comparing American with English cheese and cheesemaking, it will be in order first to take a look at the American products which embrace Canadian as well as United States cheese.

American cheese consists chiefly of a single staple, known generally as Cheddar, a term which, perhaps, is not exactly appropriate inasmuch as its early use did not cover conditions which exist in our present manufacture. Cheddar cheese was originally so called from the name of the place in which it was first made in England. The peculiarities of its manufacture were that it called for an artificial application of heat to the curd and whey after the curd had been cut or broken, to raise their temperature to 95° to 100° for the purpose of hastening the separation of whey and the hardening of the curd. Second, getting the curd out of the whey while the latter was sweet. Third, ripening the curd after it was out of the whey by packing and keeping it warm, and well drained till a certain stage of maturity was developed; and fourth, cooling and grinding before salting and pressing. Though size and form were never permanent characteristics of Cheddar cheese, they have often been used to distinguish it, the size being large, with height about equal to breadth.

There are various items in the manufacture of our staple cheese which do not correspond with the foregoing essentials of Cheddar cheese, but gradually the term has assumed this broader use and I follow the general usage. Perhaps American factory cheese would be a more appropriate name by which to designate our great American staple.

Let us now look at some of the leading peculiarities of American manufacture and their effects on the character of the goods produced.

First. It is made almost entirely in factories requiring the milk of

which it is made to be transported from the farms on which it is produced to a central place for manufacture. This, it must be confessed, works injury to the milk in some respects while it improves it in others for cheesemaking. The constituents of milk are unstable. Its fats and its sugar especially are easily altered. The rapid oxidation of its volatile oils induced by agitating the warm milk in confinement, develops and accumulates an injurious amount of animal odor, and hurries the conversion of sugar into acid. It is well known that too much of either is detrimental to the quality of cheese.

Second. The contamination of good milk by being mixed with milk faulty by reason of disease, bad food, bad water or by breathing bad air, depresses the general level of factory cheese. On the other hand there is the advantage of subjecting a large amount of milk to the skill of a single expert by which uniformity and high average quality are rendered possible, and the work done at the lowest cost. These are great advantages, but they are not always fully availed of.

In reviewing our systems of cheesemaking I propose to notice a few of the points in which we fail. Cheesemakers in the States, and in Canada and in England, are quite uniform and consistent in the preparation of milk for receiving rennet. They follow a very common rule of making cheese once a day and of having the milk in a condition as nearly uniform as possible, and at a temperature between 80° and 90° when the rennet is applied, and use a strength of rennet that will produce a good coagulation in an average of about forty-five minutes. This would all be legitimate enough if the rennet was rightly prepared and sweet. But here is where a great many American cheesemakers go astray. They soak their rennets in whey, always a stale product in its best state, and often badly warped by infection from bad milk, and generally sour and frequently in a state of putrefaction before it gets into the milk. Bad rennet, though it may not entirely spoil the cheese, always warps its flavor and affects its curing and keeping. Damage to the amount of hundreds and hundreds of thousands of dollars has been done to the cheese of this country by the use of whey in the preparation of rennet, for which there was never the slightest necessity nor even excuse. It is easier and safer to prepare rennet without whey than with it—easier to have it sweet and sound than to have it stale and sour. The best, the safest and easiest way to prepare rennets is to soak them in a supersaturated brine made by putting into water that has been boiled and cooled a little more pure salt than the water will dissolve, using stone jars to do the soaking in. It will only be necessary for the maker to see that the rennet skins are kept under brine and that the brine is often stirred to prevent the animal matter that soaks out, from rising to the surface and spoiling by being too long exposed to the air.

I do not know how it is in Crawford county now, but the last time I traveled among her factories I think it safe to say that more than every other maker was soaking his rennets in whey to the great detriment of his cheese. The practice was then just as common in Canada as in the States, and if any different, even more so, but since the cheese-producing districts have been traveled three or four times over by public instructors they have so far discouraged the use of whey that it has been pretty much abandoned and brine soaking or rennet extract has taken its place.

The English cheesemakers are much more particular in the matter of rennet than ours are. I traveled a month in England among the

factories and farm dairies and never saw a case of bad rennet in the time. All I saw amiss in respect to rennet was a sample of poorly made extract in one of the factories. Cases of faulty rennet may exist there. Very likely they do. I was told that they occur quite frequently in Scotland. I do not know as to that as I did not go there. But judging from what I saw in England I think the dairymaids entitled to credit for their neatness and care in the preparation of rennet. Their skill in this respect contributes much to the excellence of English cheese. I think the use of whey in the preparation of rennet is diminishing in this country slowly—I hope so, at any rate—and that rennet extract is gradually taking its place. Being preferred by reason of its greater convenience, its own strength and its greater cleanliness, its cost now not varying much from the cost of rennets. A change from whey to almost anything else would be an improvement.

In regard to cutting curds, heating them and stirring them while heating and manipulating them up to the time of getting them out of the whey, there is very little occasion for criticism. This part of the work is usually done in a fairly skillful manner. The same rule obtains at home and abroad of cutting the curd into half inch cubes when it will break with a clean fracture before the finger as it is passed slowly through the curd.

The modes of heating and stirring the curds, as practiced in our factories till they are considered fit to be separated from the whey, are not exactly uniform, but they are well enough performed. When it comes to the point of separating the curd from the whey and deciding upon the treatment it shall afterward receive, practices differ radically and make wide differences in the quality of cheese. Probably in nine-tenths of the factories of the United States, and in more than one-half of the factories in Canada, the curds are permitted to lie in the whey till the whey is distinctly sour—in other words, till they will respond to the hot-iron test. This practice makes easy work for the cheesemaker, for as soon as his curds are out of the whey and drained and a little cooled, he can salt them and put them to press with a fair assurance of having cheese of uniform quality, that will stand the exposure of imperfect curing rooms in which the heat runs from 50° to 90°, and of standing the hardships of commerce, and of finding a ready purchaser at a fair price, generally corresponding to the quotations by cable. Besides the general merit already noticed, cheese thus made has the special merit of being solid in texture, hard and firm in consistency, freedom from huffing, and consequently very sure of keeping in shape.

The demerits of this process are that the cheese is too dry and too hard to please the taste either of American or foreign consumers. It lacks fine flavor, is mealy instead of being silky in texture, and is so difficult of solution and of digestion that only the strongest class of stomachs can safely use it. It is further defective in the fact that it fails in dealing with milk which is in any way abnormal. If the milk is in perfect condition, and the souring is not too deep, a fine cheese may result, but if the milk in any way varies from its normal condition, as it often does from variations in the food and health and usage of the cows, or is strong smelling, or more gasy than usual, it is very sure to go wrong in some way. The curds will float, or the cheese leak, or huff, or stink, or have a disagreeable odor or flavor, or be short lived.

By leaving curd in whey until it is sour, the whey, according to the degree of its acidity, dissolves the mineral matters out of the curd, thereby rendering the cheese an imperfect food. The saline constituents of our food are just as important as the flesh-forming or heat-producing parts. They are necessary for building up the bony structure and teeth. They enter into the cartilages, tissues and fluids of the body. Blood will not form without them. If the saline parts of that life-sustaining fluid were to be withdrawn from it, it would thicken and stagnate in our veins and terminate life. It is just as much of a robbery to the cheese to dissolve out the mineral matters of the curd and pass them off in the whey, as it would be to take the cream from the milk for making butter.

The system of cheesemaking I have described is what is known as the acid process, in distinction from the sweet practice or practice of separating the curd and whey while sweet. It has changed materially within the last eight or ten years. The curd is now often taken from the whey at a much earlier stage—often when acidity is barely apparent—and the curd stirred in the sink or vat to cause it to advance to about the same stage of maturity before pressing that it would have acquired if left longer in the whey. This gradual change has worked a great improvement in the general character of American factory cheese, but there is a wide chance for improvement open yet.

The English Cheddar process, the leading characteristics of which I have already pointed out, and a modification of which I have urged upon the dairymen of Canada and the States, may very properly, in this connection, be contrasted with the acid process which the great majority of cheesemakers at this date are still pursuing.

The genuine English Cheddar process which is, to some extent, in use in this country, is in a measure at least, an acid process. The ultimate aim of the great advocate and teacher of that process, Mr. Joseph Harding, of Marksbury, England, was to sour the curd before salting it and putting it to press. He took the curd from the whey while apparently sweet, but to bring on acid the sooner, he is reported to have added sour whey to his sweet milk, when he added the rennet for coagulating it. By this means less time was required to keep the sweet curd packed in the vat or sink to induce the acidity he deemed important before pressing. The cheese made by Harding's process was generally excellent, but the reasons he assigned for the process are questionable. He proceeded with the idea that acidity was the active and controlling agent in converting curd into cheese, and he employed artificial means to bring it on when natural means did not develop it within the time he thought it should be present. The great body of American cheesemakers are to-day in accord with this idea, and the same view prevails to a large extent in England. My view, on the contrary, is that the conversion of curd into cheese, as well as the conversion of milk into curd, is effected by rennet as the controlling cause, and I direct the manipulations of manufacture with this end in view. Having found that lactic acid—the acid in sour milk and whey—counteracted the action of rennet, I have opposed treating sweet milk with sour whey to make it work fast, and most pointedly oppose allowing the curd to lie in the whey till the latter was sour for reasons already indicated. In the treatment of the curd after it is out of the whey, I have followed very closely the Cheddar process in maturing the curd for the press, with this difference, that I was not quite so particular about waiting for acid before pressing.

It was this process which I undertook to introduce into Crawford county in 1878 and 1879, with not a very flattering success, and which, with a very satisfactory success, I did introduce into Canada in the year last named, and which every public instructor who has succeeded me in the Dominion has followed and taught until about one-third of the Canadian product is made on this plan. With the result of making such an improvement in the quality of Canadian cheese as to raise its reputation from an inferior position to one which gives it a decided preference to the cheese of the United States in the markets of the world. While in Liverpool and London last June, the average price of States cheese was forty to forty-two shillings sterling, while Canadian cheese, of the make described, commanded forty-eight to fifty shillings. The superiority of Canadian as compared with States cheese was everywhere conceded. There is, however, considerable cheese still made in Canada on the strict acid plan of souring curds in the whey, and salting and pressing at once, or as soon as sufficiently drained and cooled. But where drawing sweet has not yet been introduced, the more general custom is to draw the whey at the first approach of acidity, when the curd will spin on a hot iron, say one-fourth of an inch, and to hold the curd in the vat or sink for a while till the hot-iron test becomes more pronounced. This is a decided improvement over the old acid process of souring distinctly in the whey.

All of the Canadian cheese is made in one or the other of these modes. While Canadian cheese varies considerably in size and quality, the whole make of the Dominion may be reckoned as but one variety of staple cheese for export. There is no fancy cheese made worth mentioning.

In the United States it is a little different. Though not in a very large way, a variety of sorts is made. In Ohio a soft, broad, thin cheese is made for local consumption, resembling somewhat the Gruyere of Switzerland in form and size, but is generally softer than the true Swiss. Its manufacture borders upon the acid process, but less so than formerly, and the make has been improved by the gradual change toward drawing the whey entirely sweet. A further improvement might be made by pressing it in smaller hoops and retaining its present thickness, as the cheese would be so much more convenient for handling and cutting. As it is, it has established a permanent reputation and is in fact much better adapted to the American taste than the hard and dry cheese of the full acid make, and finds a ready market for domestic consumption, none of it being exported. It is made to the extent of several millions and is known as the "Ohio flats."

There is also made, chiefly in northern New York, but in a small way in several other States, in all perhaps six to eight million pounds annually, of Limburger cheese, all of which, like the Ohio flats, is consumed in the United States. Its manufacture is begun and continued in the same way as Cheddar cheese till it comes to the scalding. Less rennet is used and less heating the curd is done than in the make of common cheese. The curd is taken from the whey while soft and full of moisture and placed in molds to drain. In due time it is salted by rubbing salt on the outside of the brick-shaped blocks of cheese, but is never pressed. The curing is done in a cool damp place, and is effected by the combined action of rennet and fermentation, in which the latter takes the lead. It acquires a decided odor,

generally loathsome to the uninitiated, but for those accustomed to its use it is a palatable and wholesome cheese and gives a good return for the milk employed in its manufacture.

Then we have a little of the American Switzer Kase, or Gruyere, a good imitation of the genuine Swiss cheese. In form the cheeses are broad and thin and rather soft in texture. The manufacture begins the same as with common cheese and so continues up to the time of the so-called scalding, which is considerably higher than for common cheese. In Switzerland, scalding as high as one hundred and twenty degrees to one hundred and forty-five degrees is reported. The curds are pressed while soft, sweet and hot, and without salting, in order to fill the meat of the cheese with well developed gas holes, which is deemed an essential characteristic of the cheese. It is salted after pressing by rubbing salt on the outside. When well cured it is a fine cheese—rich and plastic in texture, palatable, and wholesome by reason of its easy digestion. The whole of the cheese so made goes into domestic consumption. It is one of the oldest varieties of cheese, known to the civilized world, being many centuries old. It has been a leading article of export from Switzerland for many hundred years. It has probably had a broader distribution and is better known, and has pleased more palates than any other variety of cheese now known. It may be worth noting that this famous cheese is strictly a sweet curd cheese—acid not being allowed to appear in any stage of its manufacture. Then we have a few varieties of fancy cheese made in imitation of European varieties, for the use of European immigrants who bring their foreign preferences with them—preferences which, for the most part, are better supplied by importation from the localities the immigrants have left than by manufacture here. To satisfy the tastes of our adopted citizens, besides similar cheese made here, about six million pounds of what may be styled fancy cheese are annually imported.

English Cheese.

Statistics relating to the dairy have not been as carefully collected in England as in the United States, but according to the estimates of Professor J. P. Sheldon, the total make of cheese in England is about the same as ours. English cheese is made almost entirely in dairies, there being, as I was told, only about eighty factories in England, while American cheese is made almost entirely in factories, there being in the United States and Canada from eight thousand to ten thousand factories. English cheese of the same variety is less uniform than American, but judging from what I saw it averages quite as well.

There are more varieties of cheese in England than with us. Almost every other county has a variety of cheese bearing its name, and generally the different kinds of cheese take the name of the locality or county in which each originated or is chiefly made, as Cheddar, Stilten, Dorset, Leicestershire, Devonshire, Gloustershire, Wiltshire, Derbyshire, and so on, each varying a little in the mode of manufacture or in form or size. In substantial characteristics the different sorts of English cheese often have much in common. Judging from what I saw in the districts in which I traveled, the Cheddar, as with us, appeared to be leading variety. It originated in the south of England, but is now made in almost every part of England, and very largely

in Scotland. Its manufacture has been already described and need not be repeated, but I may remark that there is less acid used in England than in American Cheddar cheese making. Another leading variety of cheese in England is the Cheshire. It is an old sort and has for a long time been a popular cheese. In texture it is soft and rich and when skillfully made is delicious in flavor. The cheese in some of the dairies I visited was the finest of any I saw in England and brought the highest price. In a considerable number of dairies I saw sixty-five shillings a hundred paid to the farmers for their cheese delivered to the nearest station without boxing, in the month of June for cheese thirty days old, equal to about fourteen cents a pound, while American cheese was selling in Liverpool and London at forty shillings a hundred or eight and a-half cents a pound, and netting our farmers about seven cents. Some of the Cheshire cheese brought the farmers only fifty shillings.

Cheshire Cheese—How Made.

I made the following notes of the work in a Cheshire cheese dairy in Shropshire, adjoining Cheshire, which sold for sixty-five shillings.

Cheese made once a day from thirty cows; night's milk set in cheese vat and kept at 65° to 70°; some set in crocks or pans; rennet applied at 81°, and vat covered; curd ready to cut in one to one and one-fourth hours, and cut, as in American factories, into one-half inch cubes; settled one-half hour, and then whey run off; dipped at once into a drainer with slatted bottom covered with cloth, the edges of cloth drawn up over the curd and weight laid on to hasten separation of whey, the position of the curd changed occasionally by drawing up the corners of the cloth and readjusting the weight.

When firm enough, in about two hours, the curd is broken fine and salted, two and one-fourth pounds salt to one hundred pounds curd. Put into hoops in a press cloth, and set in an oven at 80° till next day, turned once in the time; next day put to press under one thousand pounds pressure and pressed five days, or so long as the cloths which are changed daily will become damp.

The curd was often perfectly sweet after remaining in the oven at 80° twenty-two hours. I think twenty-five per cent. less rennet is used in making Cheshire cheese than in making Cheddar in America, often curding in one and one-quarter hours. Cheeses were pressed in fifteen-inch hoops, and weigh about thirty pounds, but in different dairies they differ greatly in form and weight. It was thought milk set in crocks or pans in a cool place kept the night's milk too sweet to make best cheese. In some dairies no drainer is used. Curd is drained in the vat and ground with a curd mill. Two to four cheeses are pressed in one upright press.

The setting and salting are very irregular in different dairies. Setting occurs at 70° to 94°, and salting varies from two to four and one-half pounds to one hundred pounds of curd. This difference is chiefly due to difference of whey in the curd. In some cases a part of the salt is put on when the curd is first put to draining, the rest when ground or broken up. Some put a little salt in the milk, but I saw nothing of this.

Some put the curd in the oven tied in a cheese cloth with a weight on it, and grind and salt next day when taken from the oven to be put to press. Nearly every Cheshire cheesemaker makes butter from the whey, which sells at eight pence, or sixteen cents a pound, generally

bartered for groceries. This dairy of thirty cows made ten pounds a week, which is less than the average yield; some get a pound a week from each cow. It was generally nice, and many farmers used it on their tables.

Derby Cheese.

Another popular variety is known as the Derby cheese, so called probably, because largely made in Derbyshire and vicinity. I made the following notes of its manufacture:

Night's milk, skimmed; night and morning's milk mixed and set at 80°, made once daily, sometimes twice daily, enough rennet to coagulate in an hour; cut into half-inch cubes or carefully broken; when the great bulk of whey is separated the curd is put into hoops and lightly pressed to help get the whey out of the way, then taken from the hoop, cut into chunks and repressed, repeated till the whey is about all out, then ground and pressed two or three days, and salt applied to the outside of the cheese.

No artificial heat is applied after setting—curd pressed perfectly sweet. Acid may or may not occur before salting. The cheese is pressed in fifteen-inch hoop and weighs thirty pounds. Noted improvement in Derby cheese by keeping over a little unsalted curd to be mixed with the next day's cheese.

Leicester Cheese.

Professor J. P. Sheldon describes the usual method of making Leicester cheese as follows: "In spring and autumn the temperature of the milk when set for coagulation is 80° to 84°, but in summer not higher than 76° to 78°, and sufficient rennet is added to cause coagulation in about an hour and a quarter, more or less. The curd is then slowly and carefully broken down, so as not to bruise it, and liberate the butter, and after the curd has had time to settle down to the bottom of the vat, a process that generally takes about twenty minutes. The whey is either ladled off or run through a tap in the bottom of the cheese-pan, if it has a tap. In very cold weather the whey and curd are in some cases heated up to 80° or 84°, after the curd is broken. The curd is then gathered into a cloth, is pressed and broken several times until the whey is removed, and before it is finally vatted for the press, about two to four ounces of salt are mixed with the curd of each forty pound of cheese, in order to make sure that it is cured. The cheese is after a time turned and dry-clothed, and when it has been twenty-four hours in the press, is well salted on the outside, a process that is repeated each day for four or five days; the cheese is then well washed in warm whey or greasy water, and put on the shelf to dry. The ripening takes usually six or eight months, and a fine quality, well-made Leicester cheese, improves by keeping twelve months. * * * * The quality of a fine Leicester cheese is always very superior; the flavor is rich, clean, full and nutty. The texture is firm without being close or dry, flaky rather than waxy, and moist, as opposed to wet, it is a very 'meaty' cheese and rich, and the flavor left on the palate is very agreeable."

I visited a few of the cheese factories and found the manufacture similar to our acid process, but the cheese is not so hard and dry as ours. In others I found the work done by the Cheddar process, with the whey drawn sweet, but pressed Derby shaped, thirty-pound of cheese in a fifteen-inch hoop, instead of pressing them thick, as we do.

In looking over the cheese of England it was a very noticeable fact that the average make of the country, and especially of the highest priced cheese, was decidedly soft as compared with American factory cheese. In the old Longford factory, the first one built in England, cheese is still made by the acid process then introduced by the American maker, but it is as soft as the Ohio flats and appeared very much like them. It was then selling (in June) at forty-five shillings without boxing. In Lord Vernon's factory at Sudbury—the site of the Sudbury Dairy School, the whey was drawn sweet and curd ripened in the vat, packed and ground—in the same way I have recomended, except that more moisture was left in the curd than I have advised, making the cheese what Crawford county factory men whould call decidedly soft, but still it sold at from forty-five to fifty shillings a hundred—mostly at the latter figure. It cured quickly, appeared rich and had a mild, clean and agreeable flavor. The pupils in the school were taught to make such cheese. The Stilton and other varieties of cheese which I saw made were also soft.

In observing the characteristics of English cheese as compared with American, which I did very carefully and with a deep interest. I was forced to the conclusion that the English taste did not differ materially from our own, that if we offered them cheese which would suit our own palates we should suit theirs equally as well. Nowhere did I find anybody making the hard, dry, sour, mealy cheese, like that turned out from so many of our factories, and when it is sent there from this side, it invariably goes at a discount as compared with the softer English factory cheese, though it may outsell some of the poorly made dairy cheese.

The plain fact is, the dealers who have been profuse with their instructions in regard to how cheese should be made, have instructed makers wrongfully when they have insisted upon the necessity of putting on heavy acid, and they have misled the makers to the infinite disadvantage of everybody but themselves. Hard cheese is safer to handle than soft cheese as the latter is easier broken by accidents, but the danger is small even with cheese quite soft. The dealers who have done so much mischief may be honest in their errors, perhaps they are. We are bound to regard them charitably, but men who give advice affecting the welfare of others ought to know what they are talking about.

But the dealers are not the only ones at fault in this matter of sour cheese. Those who build cheese factories and make cheese often have their hands stained with the blood of the innocent. The way the stain comes round is about as follows:

At a centre where milk enough to pay for making it into cheese can be collected, a company, or a single proprietor, builds a factory and equips it with the labor-saving apparatus necessary to making cheese at the least cost. The margin for profit is small and he builds cheaply. Both the make room and the curing room are so cheaply sided and open as to feel all the variations of the outside air. If he attempts to make Cheddar cheese in such a place he gets along all right if the weather is warm, so that his curd which has been dipped sweet can be kept warm till it ripens enough to remain firm in the curing room, but if the weather is cold the sweet curd will chill and fail to ripen and after fussing with it all day he puts it to press green and full of moisture and in this condition it goes into the open curing room, and so long as it remains cold his soft cheese gets along all right, but when

the weather changes and the mercury runs up to 95° inside the room, his green cheese swells and bloats like a puff ball and soon goes off flavor and spoils, and the conclusion is reached that Cheddar cheese is "no good" and it is abandoned, and the maker resorts to the acid process for safety. He now leaves the curd in the whey till it is sour. This makes a thorough separation of moisture, hardens the curd and kills the rennet in the curd to an extent that makes the curing so slow that nothing can disturb the cheese, whether the temperature be 50° or 100°, and it calls for the least labor.

Had the curing room been such that it could have been kept at a sufficiently low and even temperature the green cheddar curd might easily have cured into a strictly fancy cheese.

If the milk is all right and the curing room is all right, the curd may lie in the whey as long as it can and remain sweet and then be drained and salted and put to press at once without souring or cheddaring and come out a fancy cheese in due time. When the milk and curing room are right, neither souring nor cheddaring before pressing is a necessity. The cheese of the world proves this. It is safe to say that nineteen-twentieths of the cheese made in the civilized world is separated from the whey and pressed sweet and without any extended maturity.

But in cheese factory practice, when from any cause the milk becomes faulty, as when it becomes filled with odor in being transported to the factory, or from other cause, or contains other foreign odors, such as the odor of onions, turnips, cabbages or other strong-scented herbage, they can only be removed by airing the curd while warm and sweet. If they remain in the curd till it sours they cannot be removed. The acid will take them up and hide them for a time, but after a while the acid will decompose and set the odors free and they reappear in the cheese to its injury or ruin. So much of the milk which goes to the cheese factories is in some way faulty that the safest way is to have a warm make room and cheddar every day. Thus it is clear that acidifying the curd is not a necessity in cheese-making, and that our use of it in our factory practice, is only paying the penalty for having faulty curing rooms.

THE PLAGUES OF THE FARM AND THEIR REMEDY.

By Dr. G. T. Rankin, *Linesville, Pa.*

This ought to be an interesting subject to present to a meeting of farmers. They are very numerous and ought to be attended to with vigilance and a determination to either exterminate them from his premises or fetter them so they may do the least harm possible, no matter in what form they may show themselves, and they will quite often bob-up their hydra heads where you are least expecting them. I hardly know where to commence an attack, as they are so numerous and so varied in different localities, but there are enough in common, that are interfering with our profits of honest toil and efforts to meet our engagements, to live the lives of honest men by being able to pay our debts and have a little left for the showers and the sleets of old age, when if we wish to be respected, we must be *entirely solvent.*

The misfortune of fires, storms, floods, cyclones, lightning, protracted sickness, loss of mind, and such natural and accidental calamities cannot be considered plagues that can be prevented by vigilance, but the losses resulting from their visitation can be reduced by insurance policies, in reliable companies, containing clauses covering losses from nature's outbreaks; from the employment of regular physicians who are honest (if you can find any), and by taking proper care of the *cranks*, before they run the farm to ruin.

To rid our farms of the plagues, and learn the best remedy to counteract their effects, is a Herculean task to accomplish in our short lives, but one worthy of mighty effort, if we keep in view the good of our country in the years to come. It is said that the sun will not last to heat and light the earth only 90,000,000 more years until it will wink out. Even if this is true it should not discourage many of us here present, as it is likely to last as long as we will need it. We should let nothing discourage us in getting rid of the plagues for our own benefit, that of our children and their children, and all future generations, that they may bless us with hymns and anthems that will be pleasing to hear in our new homes beyond the present scenery, if we should happen to have ears that can take in the sound. At least let us do all we can while upon earth to leave a name and a small heritage for a monument, that may prove that we were here, as we carry nothing with us but a coffin and our grave-clothes.

The Plagues.

The ones that can be controlled or exterminated from our farms are drought, weeds, worms and winged birds, scrub stock, "fool farmers," low prices, dogs and our boys and girls, and if we should ever be able to outwit all of them in their plaguish work, we will become a very prosperous class in the race for winning, and stand in the front ranks in any community where style of dress equipment, is not considered the *sine qua non* of an entire existence.

We will consider the plagues in order, and suggest, as far as possible, the remedy.

Drought.

We cannot control the clouds in their blessings of showers, to make the pastures grow, but the plague can many times be avoided by the farmer changing the course of small streams, and conducting the water from springs to his fields to supply the moisture, and many farmers are accessible to waste swamp lands that can be ditched and cleaned up, and when seeded to tame grasses will furnish fresh pasture the entire summer, independent of the clouds, and twenty-five or thirty acres of such land will accommodate, despite a drought, twice the number of grazers that the same acreage of high lands will feed with the average showers that occur during a fair season of rain. The remedies are not accessible to every farmer, but they are to many more than take advantage of them, and suppose the swamp land was five or even ten miles away, a day's drive to it in the spring, and a day's annoyance in the fall, to get the young stock home again where there would be a good supply of hay in the mow, that was cut from the former pasture land, to keep them through the winter.

I would recommend every farmer when possible to relieve his farm from his growing stock by having a lowland pasture.

Weeds.

The most annoying of these plagues are the red sorrel, white daisies and Canada thistles. How can we get rid of them, and prevent their contagious pestilence? Salt them? Kerosene them? Pour burning acid upon their foul roots? Curse them? All, or any of these, would be of little effect. The remedy is to plow the ground year after year, sowing mammoth clover seed often enough, and by plowing it under, to secure a good crop, and keep on with drag and coulter, even if it takes years of patience to subdue them, rather than to permit their foul growth, steal away our honest wealth, and we should especially enforce the laws for their extermination, upon our negligent neighbors, who possibly allow them to grow, thinking they are posies, or are suitable for perfume extracts, wherewith to give our young folks an unnatural odor.

Bugs, Worms and Birds.

These are very difficult plagues to manage, but we can do something to remedy their ravages, especially their attack upon our cornfields, where they generally congregate for their annual "camp-meetings." We can put in extra seed for the worms, and we can soak the unplanted kernel in "coal tar" in our attempt to disgust their appetite when they find it planted, but we must never trust the ubiquitous crow to catch the worm, and leave the sprouted germ to grow. Better shoot the crows and give the worm a chance. Keep the crows away while the seed is sprouting, and the blackbirds off when the crop is maturing, by "scare crows," or loaded guns, and kill all you can, as I hardly think any farmer here would scare a crow, unless he would shoot at it.

Scrub Stock.

Of all the plagues of the farm, perhaps "scrubs" should be considered the greatest, and yet the most easily got rid of, to a great extent. The remedy is easy, and entirely practicable, and that is to stop *breeding* them, and wear out and kill off, as fast as possible, the old ones. We should have a national law, prohibiting any "scrub" or "grade" male being used for stock purposes, after a certain date, and in a few years the country would be enriched by millions of additional wealth.

It might seem to some that such a law would interfere with the rights and privileges of a free citizen of our great republic. We would ask, what prohibitory law now upon the statute that does not limit his assumed natural rights? Can he raise tobacco and roll it into "tobys" or "two-fors" without paying a special tax, which is largely prohibitory? Can he distil his corn or rye into "rot-gut" and sell it without paying a heavy tax? Let him raise his stock from scrubs and grades, and tax him when he sells them, and they soon will be numbered among the plagues that used to be.

The Fool Farmer.

Some one remarked to me that the greatest plague to the farming interest was the fools that were trying to farm. I am sorry if any fool is in the farming business, as but little foolishness can be indulged in, however much may be supported in the different trades and other professions, as successful farming means business up in the

scale, with but few opportunities of taking the hide off anybody. The fool farmer might become a great plague if they should become numerous and control, or influence, the intelligent farmer, but as things now are there is no danger, and he will wear out his existence fooling with plug horses, scrub cattle, scraggy sheep, long-nosed pigs and dung-hill fowls, with his fields full of noxious weeds, his fence corners ornamented with briars, and his cornfield only half worked because it is not "grassy," not knowing that it is the frequent stirring of the soil that makes the crop grow. No remedy need be suggested, as it is a self-limited plague, and will pass away through the effect of surrounding influences.

Low Prices.

They are truly a very provoking plague to the farmer, who toils the year through, as even the legal holidays are no play days for him, as the press of business is always upon him with its mighty weight.

My remedy is theoretically correct, but may not always be practicable, unless the farmer has a good balance credit at the bank, which he should always have. It is, never to sell any product off the farm except for a price that will compensate for the labor expended and a fair interest upon the money invested in the farm and its appurtenances. Form combinations in every county, extending them by conventions to States, and by States to the whole country, as do nearly all manufacturing producers, and fix your own prices upon your products. If the market will not pay them, keep the products until the city people get hungry or tired walking—pack your butter, pickle your eggs, garner your grain, stack your hay, and when you do not want to churn any more milk and have no more room to pack your eggs, give a free festival and treat your temperance friends to "ice cream," and the "other fellows" to "egg nog" and "milk punch," and you will get rid of the surplus, besides get talked about, which is worth something.

Dogs.

How about the household favorite, the "family dog?" I would no more think of killing a dog in a gentleman's front yard, than I would of spitting in his wife's face, or slapping his child at its innocent plays, but if I should see a dog chasing my sheep, or know of one running my cattle, I would try and scare him if I had a loaded gun by shooting right at him. A dog out of his place is a plague, and should be treated as such by getting rid of him. The few good ones are not always labeled so that we can tell them from the mean ones, and while at times they have been faithful guards, and have done good service to humanity in their sagacious moments, they have been known to spread hydrophobia in their rabid state. Dogs are a doubtful benefit to the farmer, but as their usefulness is largely the result of proper training, they should have a chance, and if they prove of use they should be indulged, otherwise they should be considered objects which ought to passively submit to a rest in "dog heaven," through the medium of a loaded gun, or a ration of beef sandwiched with strychnine.

The Boys.

The little rascals! Are they to be considered plagues? When they are twelve years old they will assume to know as much as their respectable fathers, although they may be forty upon the cycle of time,

and when the "young gentleman" arrives at sixteen, when his muscular development should make him useful upon the farm, he generally knows entirely too much to live homogeneously with his father, and becomes a real plague, but should he continue to board at home until he is twenty, he is frequently unmanagable and he ought to be turned loose, as he knows all there is of life, and the "old man" just discovers that he has been a fool for several years, if he should happen to believe the boys arguments.

The boys! The boys! The future cornerstones of not only our national existence, but the props for our existence to carry on the farming interest to success. What are we to do with them? I would say let them salt and pepper their own "hash" when they get ugly and will not hear to the *relish* of advice. They are apt to have an aversion to farm work and contract a "professional disease," or are stricken with a "mania" for clerking in a store, or something that presents itself to their minds which excludes the idea of work. As "plagues" we must be lenient in our remedy, as their mothers generally will think them too smart for farmers, but about right for a preacher, a lawyer, a doctor or to run a grocery in somebody's cellar. The remedy for these interesting plagues is to recognize the new profession of being a scientific farmer, which will not require them to learn to conjugate a Latin or a Greek verb, but learn to analyze the constituent elements of the soil, and the chemicals in manures that will supply the deficiencies in the soils to produce the desired crops, as well as to learn what to feed our stock to secure the best results in the direction of our efforts, whether for beef, milk or butter, for trotters, runners or draft, mutton or wool, and on through the whole list of the productions of the farm. The preacher who has not passed through the regular theological course is generally only an "exhorter;" the physician who has not taken a "regular course" is a miserable "quack;" the lawyer who has not passed the ordeal of legal studies is an uninteresting "pettifogger;" and the farmer that does not study his business and take advantage of the experience of others is a "clod-hopper," and generally in debt.

If we can get the boys interested early in life in farm work, and in the improvement of the stock, we will seldom have occasion to consider them as plagues, but rather great helps, not only by their loyal work, but by their advice, after they become interested. We should furnish them the best papers published upon these subjects for their instruction, in place of permitting them to read the trashy novels that are so common.

They generally are easy plagues to manage, but we must give them play-days, and be sure they have a "pony" to ride (slow). They will often try to fly before their edge wings are fledged, and consequently will frequently flop, but we must train them as best we can, to stay upon the earth, until they learn to soar into higher elevation. They are tender plants, and must be cultivated as we would a flower bed, if we would not grow plagues.

The Girls.

Are the dear little innocent things ever to be considered plagues? I always did like them! But we all know that they often get elevated ideas, and would rather pound upon a piano for three hours, to the annoyance of several people, than to occupy ten minutes in milking a cow, or a half hour in dressing a roll of butter, upon scientific prin-

ciples, that would be worth thirty cents per pound, while her good mother makes it, and it is sold for ten cents. The remedy suggested is to commence their household drill, when they commence their music lessons, making them contingent to their progress, and interest taken in the kitchen work, and we will have but few plagues among our girls, but they will be as perfect, and useful as did their grandmothers dream they would be, when they were yet only babes in the cradle.

The idea now is to make butter to eat, as well as to sell, and our children's grandmothers knew but little of the science, else Congress possibly need never have been troubled by passing an "Oleomargarine bill." Our girls are only a plague to us, if they will not learn the improved methods of keeping up their departments, in the farmers' household, otherwise they will give us trouble, until we can get them married to some young man, who keeps a "trotting horse," or runs a corner grocery. The farmer who has a girl should have a dog-churn-power, and when the churn is in action, the fellow that is "playing sweet on her," ought to be on the wheel, to spell the dog, and if he rebels, he should be driven away, unless the girl will not stand it, and threatens to follow him through thick and thin; in which case, I would say a compromise would be in order, as no farmer can with proper equilibrium, stand a runaway match, while he is trying to rid himself of the plagues of the farm.

Special Pleading.

The trouble with meetings of this kind is, we do not reach the plague farmer. He is at home growling over his poor crops, or wailing at the low prices he received for his stock. Missionaries are in order to visit every school district, and wake up their dormant livers to something like life. Thoroughbred stock breeders should raise funds, to send competent men out to talk to the sluggards. Papers should be sent to them, to convert them from their heathenism of ignorance. They are not cannibals, as they cook what they eat, but they fool away their time, raising poor crops, and poor stock, and should be attended to, for the honor and good of the common country.

PENNSYLVANIA STATE COLLEGE.

ANNUAL REPORT

OF THE

PENNSYLVANIA STATE COLLEGE.

FACULTY AND INSTRUCTORS.

GEORGE W. ATHERTON, LL. D., President: Political and Social Science.
JAMES Y. MCKEE, M. A., Vice President: English Literature and Mental and Moral Science.
WILLIAM A. BUCKHOUT, M. S., Botany and Horticulture: Secretary.
CHARLES F. REEVES, M. S., Modern Languages: Librarian.
I. THORNTON OSMOND, M. S., M. A., Physics.
JOSIAH JACKSON, M. A., Mathematics.
LOUIS H. BARNARD, C. E., Civil Engineering.
JOHN W. HESTON, M. A., Principal of Preparatory Department.
HARRIET A. MCELWAIN, M. A., Lady Principal: Latin and History.
LOUIS E. REBER, M. S., Mechanics and Mechanical Engineering.
WILLIAM HALE HERRICK, M. A., Chemistry.
WILLIAM FREAR, Ph. D., Agricultural Chemistry.
SAMUEL S. PAGUE, First Lieutenant, 15th Inf., U. S. A., Military Science and Tactics.
MILTON W. BOHN, B. A., Assistant in Preparatory Department.
HARRY J. PATTERSON, B. S., Assistant in Agricultural Chemistry.
NELSON E. CLEAVER, Assistant in Preparatory Department.
R. G. DAVIES, M. E., Assistant in Chemical Laboratory.
JULIA E. GORSLINE, Instructor in Music.

DESCRIPTION OF THE INSTITUTION.

THE PENNSYLVANIA STATE COLLEGE

Was organized in 1859 as the "Farmers' High School," and its object then was to give an exclusively agricultural education. Its organization, however, was upon a collegiate basis from the beginning; and its name was, in 1862, changed to "The Agricultural College of Pennsylvania." Subsequently, the Legislature of the State having appropriated to this institution the income from the proceeds of the National land-grant, and the scope of its work having thus been necessarily enlarged, its name was, in 1874, again changed, and it has since been known as "The Pennsylvania State College," a name which indicates the intimate connection of the College with the State Government, and its relation to the people of the whole Commonwealth.

The scope of the institution, as now organized, cannot be better stated than in the following comprehensive words of the act of Congress:

"The leading object shall be, without excluding other Scientific and Classical Studies, and including Military Tactics, to teach such branches of learning as are related to Agriculture and the Mechanic Arts, in such manner as the Legislature of the State may prescribe, *in order to promote the liberal and practical education* of the Industrial Classes *in the several pursuits and professions in life.*"

This act of Congress was, in 1863, "accepted by the State of Pennsylvania, *with all its provisions and conditions*, and the faith of the State * * * * pledged to carry the same into effect."—*Laws of 1863, p. 214.*

Based upon this broadened foundation, the special work of the State College is INDUSTRIAL EDUCATION; that is, the training of youth in those branches of learning which lie at the foundation of modern industrial pursuits. In accordance with the purposes of its founders and the terms of its original charter, it aims to give special and prominent attention to Agriculture, both theoretical and experimental. But it also provides a "liberal and practical education" in the leading branches of mathematical, natural and physical Science, in order to prepare youth for "the several pursuits and professions in life," as the laws of Congress and of this State distinctly require. While the College therefore, is no longer exclusively agricultural, it is doing more in the direction of progressive and scientific Agriculture than when that was its principal object; and, at the same time, it has greatly increased its subjects and courses of study, and its teaching and illustrative equipment in other directions. "Without excluding classical studies" entirely, it aims to teach the various sciences in such a manner as to show their applications in the more important industries, and thus to combine theory with practice. Such a course of training, aiming to cover even a part of the vast field of modern scientific knowledge, must necessarily be somewhat prolonged. But its results are showing themselves, in a most gratifying way, by the readiness with which our graduates find honorable and remunerative employment.

The range of work is shown, as far as the limits of space properly

allow, in the following schedules and descriptive statements. It is confidently believed that few, if any, institutions in the country furnish opportunity for obtaining an advanced scientific education, of equal extent and thoroughness, at so moderate a cost, and with so many incidental advantages.

LOCATION.—The institution is situated in the village of State College, Centre county, nearly twelve miles south-west of Bellefonte, and about equi-distant from the extreme parts of the State. Its position in the midst of a broad, rolling valley, with Muncy mountain on the north, Tussey mountain on the south, and Nittany on the east, secures a varied and remarkably beautiful landscape and a healthful climate.

A special act forbids the sale of intoxicating drinks within two miles of the College, and all its surroundings are exceptionally free from demoralizing influences and from temptations to extravagance.

The main college building is a plain and substantial structure of magnesian limestone, two hundred and forty feet in length, eighty feet in average breadth, and five stories in height, exclusive of attic and basement. It contains the public rooms—such as chapel, library, armory, cabinets, laboratories, society halls and class-rooms—and a large number of dormitories. The building is heated with steam, one or more upright radiators being placed in every room, hall and passage-way; is furnished on every story with an inexhaustible supply of pure water from an artesian well, and is lighted throughout with electricity. The sewerage system is frequently and carefully inspected, and the unusual exemption of our students from every form of sickness justifies the statement that the sanitary condition of the building is very nearly perfect.

CAMPUS AND FARM.—The tract of land on which the building stands contains nearly three hundred acres. Of this, about fifty acres in the immediate vicinity of the building constitute the campus, and furnish recreation grounds, sites for professors' houses, and other needful buildings, &c., the whole being tastefully laid out and adorned with trees, shrubbery, flower-gardens and walks.

PRACTICAL TRAINING.—The college has, from the first, sought to combine practical with theoretical instruction, and thus to fix in the student's mind a knowledge of both methods and principles. With this end in view, a portion of each student's time has been set apart for this training, and the number of subjects in which such instruction is given, and the apparatus for it, have been increased until it covers an extensive range of topics, as will appear from an examination of the several schedules. A portion of this training is largely technical, and so is almost wholly connected with these courses. Other parts, however, are so general in their character as to be appropriately required of all students. Among these, the following may be mentioned for illustration: *Book-keeping*, so important for the right conduct of all business; *Drawing*, free-hand and mechanical, needed by individuals in all employments aud professions; *Military Drill*, required by the law of Congress, and helpful in securing right habits of body and mind; *Mechanic Arts*, in which are learned, among other things, the making of plane surfaces, correct angles and joints, and the care and use of tools; *Horticulture*, where instruction is given in all ordinary operations belonging to fruit-culture, such as pruning, grafting, budding, and propagating by cuttings and layers; and *Surveying*, which acquaints the student with the instruments of the art, and trains him to determine points, distances and areas. Some of

these practicums not only give knowledge of almost universal use, but also serve a good purpose by developing, during the early part of the course, tastes and aptitudes which may determine the student's choice of a technical course and of his life-work.

In the Technical Courses, special lines of practice have a large amount of time given them, proportionate to their importance or looking to subsequent professional use. Each practicum is directed by an instructor who is familiar with both the theory and the practice, and their mutual relations. The instruction is so largely personal that an earnest student may advance far beyond the average attainments required as a minimum. The experience of the College adds, from year to year, to the evidence that this training is highly valuable, and in directions which no one can foresee, even when the pupil does not, at the time, fully appreciate its importance.

COURSES OF INSTRUCTION.

The organization of the College is such that the instruction given naturally falls under several departments, which are distinct, and yet so mutually related as to form, when combined in groups, well-proportioned, systematic, and progressive Courses of Study. The number of such courses is now eight, viz: A General Science Course, a Latin-Scientific Course, a General Course in Agriculture, and five Technical Courses, designated as Courses in Agriculture, Chemistry and Physics, Civil Engineering, Mechanical Engineering, and Natural History, respectively. There are, also, four shorter Special Courses. In the courses in Civil and Mechanical Engineering, the studies of the first two years are very nearly the same as in the General Science Course, being slightly varied with reference to the later stages of the work, and the strictly technical studies falling mainly in the Junior and Senior years. In the other three Technical Courses the studies *are the same for the first two years* as those in the General Science or the Latin-Scientific Course, at the option of students.

All students, accordingly, who intend taking a regular course (other than in Civil or Mechanical Engineering) enter the General Science Course, or the Latin-Scientific, at the beginning of the Freshman year, continue its studies until the end of the Sophomore year, and then either complete that course or select the Technical Course which prepares directly for their chosen work. The studies of the first two years are so arranged as to form a course by themselves, especially adapted to meet the wants of those who cannot take a full college course, but who desire to fit themselves well as land surveyors, or for any of the ordinary callings of life, at the same time acquiring a fair degree of liberal education.

Students leaving at this period of their course receive from the Faculty a certificate of their attainments.

The character of the several courses may be briefly indicated as follows:

1. The General Science Course.

The course in General Science may be taken as representing the general educational work of the college. It is designed to meet the wants of those who desire to obtain a sound and liberal education through the study of the mathematical, physical, and natural Sciences, and Modern Languages and Literatures, rather than the Ancient Classics. It provides a thorough training in Mathematics and Physics,

(with the option of the Calculus in the Junior year,) a sufficient acquaintance with the leading branches of Natural Science, (as Chemistry, Botany, Geology, &c.,) and as much study of Mental, Moral and Political Science as is found in the usual college course, while the literary studies include an extensive reading of French, German, and English Literatures and literary history. No student can fairly complete this course without having acquired a stock of recent knowledge and a degree of intellectual training which will fit him to enter successfully upon any chosen career, and furnish an admirable and effective equipment for the duties of American life and citizenship.

2. The Latin-Scientific Course.

This course is nearly the same as the General Science Course, with the substitution of Latin for the first five terms in place of other studies. The course is shown in full in the schedule of studies. The instruction in Latin is wholly optional, and while it is not so extensive as in institutions in which classical studies are allowed to take the leading place, it is given with equal thoroughness and breadth, and is sufficient, both as an instrument of mental training and as an acquisition of learning, for all the needs of ordinary college students.

3. Courses in Agriculture.

In this subject three courses are provided—a General Course, an Advanced Course and a short Special Course. The object of the General Course is to meet the wants of students who wish to begin the study of Agriculture immediately after leaving the public schools, and for admission to this only a knowledge of the common English branches is required. The object of the Advanced Course is to give to young men a more thorough *education* at the same time that they are carefully instructed in the relations that the sciences bear to the various branches of Agriculture; to give both the mental training that is indispensable to success and the scientific and technical knowledge requisite for becoming efficient workers in agricultural directions, whether as farmers, teachers or investigators. Any lower aim would fail to meet not only the requirements of the laws under which the College is organized, but the progressive demands of the time.

To this end the State College offers to the student of Agriculture something more than the meager advantages of a manual labor school, on the ground that otherwise the desired objects could not be reached, and that it is both useless and unjustifiable for a young man to incur the expense of a college course in order to acquire the manual dexterity that could be secured with little cost elsewhere, and which every farmer's son obtains early in life. The aim in the courses in Agriculture is to teach how the principal branches of physical and natural science are applied to the business of farming, and to afford a thorough and comprehensive knowledge of its principles and methods. They explain the nature of soils and manures, the reasons for and the best methods of tillage, the constituents and characteristics of plants and animals and the conditions favorable to their development. They combine practice with theory wherever the processes involve skilled labor, but do not consume the student's time in the mere manual process of plowing, planting and feeding.

As will be seen by an examination of the schedule of studies and practicums of this course, the time is fully occupied with instruction

in the class rooms, laboratories, orchard, vineyard and field, and no pains will be spared to give the earnest student a high degree of intellectual training, and a thorough, special preparation for the most advanced requirements of the farmer's calling. There seem to be comparatively few who desire to avail themselves of the advantages offered by the agricultural departments of industrial colleges. It is suggested, however, to those who are ambitious alike of usefulness and distinction, that the field of study and research in the interest of agriculture offers many great and inviting rewards to the diligent investigator.

The studies of the first two years include Mathematics, Surveying, the general principles of the Sciences, the Modern Languages and Rhetoric, with Latin for those who desire it. The direct application of science to agriculture and the consideration of purely technical subjects are reserved for the last two years, after the student has gained a sufficient basis of general knowledge. Instruction is given in connection with text books whenever suitable ones are available, but in some cases the subjects are of necessity presented by lectures.

The subjects taught after the beginning of the Junior year are so arranged that each is in some degree preparatory to those that succeed, and are grouped under general topics as follows:

Agricultural Chemistry.—The chemistry of soils, of vegetable and animal life, and of processes having relation to agriculture.

Agricultural Engineering.—Including drainage, the building and repairing of roads, foundations, preservation of structures of wood, &c.

Fertilizers.—The sources, composition and manufacture of commercial and farm manures, and their use in the production of crops; soil exhaustion; maintenance of fertility, &c.

Crops.—Implements and special methods related to each farm crop.

Stock Breeding.—The history and characteristics of the various breeds of cattle, and the laws and methods involved in successful breeding.

Cattle Feeding.—The composition of the various cattle foods and of the animal body; the chemistry and physiology of digestion and the laws of nutrition; the kinds, sources and preparation of cattle foods, and methods of feeding for different purposes.

Veterinary Science.—The hygiene of the farm; causes and remedies of the more common diseases of domestic animals.

Farm Economy.—A comparison of the various systems of husbandry, with suggestions as to the business management of the farm.

Dairy Farming.—The physical and chemical properties of milk, and the best methods of manipulating it in the manufacture of butter and cheese; the breeds of cows best suited for dairy purposes; care and management of cows, &c.

Sheep Husbandry.—The origin and characteristics of the different breeds of sheep; the adaptability of each to the various conditions of climate, &c.; and the best methods of management for wool growing and the production of meat.

History of Agriculture.—The relations of agriculture, past and present, to social and political conditions, and to education, literature and science.

The character of the short Special course (of two years) is sufficiently indicated by its title. It is devoted almost exclusively to direct instruction in agricultural subjects, and is designed for those who wish to pursue them for a limited time only.

Information as to instruction in other subjects belonging to the Agricultural Courses is given under the departments of Botany and Horticulture, Zoology and Geology, &c.

PRACTICUMS.—It is intended that the management of the College farms shall be such as is sanctioned by the teachings of science and practice. Of this management in its various details the students of the courses in agriculture are to be observers, taking part in actual labor to the extent that is necessary for proper observation. The object of the practicums will in all cases be to secure from the student a report of the operations coming under his notice, with a discussion of the principles and a criticism of the methods involved.

The facilities for becoming familiar with the growing of the ordinary farm crops, the use of commercial fertilizers, the manufacture and use of farm manures and the feeding of animals for the production of meat and milk are now entirely adequate for ordinary instruction.

4. Course in Chemistry and Physics.

The instruction in this course is designed for those who wish to become practical or professional chemists or physicists, as teachers and investigators, metallurgists or manufacturers in chemical industries, or for those who wish to pursue medicine, pharmacy, mining and similar professional or industrial occupations.

The extensive and well-equipped laboratories afford ample opportunities for qualitative and quantitative work in both chemistry and physics. They enable the student of physics to verify the action and laws of physical force, the assayist to determine the value of ores, and the agriculturist to ascertain the composition of his organic products. Probably no two subjects of scientific study are intimately connected with so wide a range of modern industries as those which make up this course. During several terms past more than usual attention has been given in the department of Physics to the recent important development of electrical science and its extensive practical applications, and a full four years' course in electrotechnics is projected.

5. Courses in Civil and Mechanical Engineering.

The object of these courses is to give thorough instruction in the studies and practical work pertaining to the two professions. The same studies to a considerable extent are necessary to the architect also, and to the mining engineer, and are valuable to any who desire proficiency in the applications of mathematics or physics. The work of the courses is so arranged that students may become thoroughly familiar with the theory and practice of field operations, the use and care of instruments and the work of the drawing room, and through systematic training may establish a sound basis for future usefulness and success in the higher branches of the profession or any of its specialties. The harmony between theory and practice and their mutual dependence is dwelt upon in order to develop the power to think as well as the ability to execute. To this end experimental as well as rational methods are habitually introduced—as, for instance, while studying the principles from which the resistance of materials is deduced, the student verifies them by experiment in the workshop; and in like manner at every stage of the work the applications of principles are taught as second in importance only to a thorough knowledge of the principles themselves.

6. Mechanic Arts.

Combining shop-work and study.

This course was begun about five years ago, but has lately been reorganized and greatly extended, and went into full operation in September, 1884. It is designed to afford such students as have had the ordinary common-school education an opportunity to continue the elementary scientific and literary studies, together with mechanical and free-hand drawing, while receiving theoretical and practical instruction in the various mechanical arts.

The instruction in shop-work is given by means of exercises so planned as to cover, in a systematic manner, the operations in use in the various trades. The object of the course being to give instruction in the use of tools, only such constructions are made as cover principles without ndue repetition. The first instruction in carpentering and joining is in the use of the saw and plane in working wood to given dimensions, and a series of elementary exercises follow in order; such as practice in making square joints, different kinds of dovetails, the various tenons, roof-trusses, panels &c. The instruction in turning and circular section pattern making is given from a series of models; also bench patterns are made for subsequent use in the foundry.

The foundry course consists in casting from the patterns which the student himself has previously made. Many of the pieces cast from these patterns are used in his clipping and filing work.

In the forge shop are taught the management of the fire and the degree of heat necessary to forge the different metals. Drawing, forming, bending, upsetting, fagoting, splitting, punching, chamfering, annealing, tempering, case-hardening, &c., are taught by means of a series of exercises in which the elements of the iron-forger's art are particularly dwelt upon. Every piece is made to certain dimensions laid down upon the drawing, the article being forged before the class by the instructor, who directs attention to the essential features of the operation, which is then repeated by each student. The course in vise-work includes filing to line, filing to template, free-hand filing, fitting and chipping straight and grooved surfaces in cast-iron, wrought-iron and steel. In the machine shop the student, after having the lathe and its mechanical construction explained to him, is taught centering, tape-turning, chucking, reaming, inside and outside screw cutting, bolt-turning, &c. He is then required to construct some piece of mechanism in which many of these principles are involved.

Some may think that the variety of operations in the mechanic arts is so great as to make it impossible to give the student any real knowledge in the time at his disposal. It should be borne in mind, however, that this multiplicity of processes may be reduced to a small number of manual operations, and the numerous tools employed are only modifications of, or convenient substitutes for, a few tools which are in general use. The uses of the lathe are, to a great extent the same, whether the material is bone, metal or wood; whether the moving power is derived from the workman's foot, from a water-wheel or from a steam engine. Again, as fitting depends on a correct eye and manual skill, he who has learned to fit in metal by means of the clipping-hammer and the file, will not long find difficulty in fitting wood by means of the saw, the plane and the chisel. Mastery over a few processes and a few tools of universal application, acquaintance with the methods of fitting and finishing, and with the ordinary

means of transmitting and converting power, are then the essential points embraced in this course.

The drawing of the course extends through the entire three years. This work is looked upon as of the highest importance, and the effort is to make the instruction thorough, practical and of direct utility. Considerable time is devoted to free-hand drawing, as it is believed that it not only assists in mechanical drawing, but is of great service in after years, whatever the occupation.

The mechanical drawing consists of a series of exercises, and such are selected as will be of subsequent use. They are arranged in progressive order, beginning with geometrical constructions involving straight lines and circular arcs only, and ending with the more complex curves, such as the ellipse, helix, epicycloid, &c. Projection is next taken up. The instruction in this is from models, so that the student may have before him the actual object from which the projection is made, and not be obliged to depend upon his unaided conception. After completing this work, he is required to draw parts of machines from actual measurements. For this purpose he is given some piece of mechanism to sketch and measure, and of which, finally, he is to make complete working-drawings.

In mathematics, the instruction covers algebra, plane and solid geometery, plane and spherical trigonometery, land surveying and mechanics, taught with special reference to this class of students, many practical applications being made. Candidates for this course must be at least fourteen years of age, and pass a satisfactory examination in the folowing subjects: Robinson's Complete Arithmetic (or its equivalent) to ratio, English Grammar (Syntax and Etymology), Geography and Spelling.

7. Ladies' Course in Literature and Science.

Young women are admitted to all classes in all Courses, on the same terms as young men, but a separate course is also provided containing more of the branches of study that are thought likely to be especially serviceable to them, with less extended requirements in Mathematical and Scientific studies. Parents who send their daughters to the College may rely upon their being surrounded by kindly and healthful influences, under the direction of a competent lady principal.

Young ladies not residing at their own homes occupy rooms in the portion of the main College building set apart for their use, either taking ther meals with the boarding club or combining in groups to board themselves, facilities for that purpose (and some slight aid) being provided by the College. Table board can be obtained for them, when desired, in excellent private families.

The course in detail is shown in the catalogue, which will be sent on application.

8. Partial Courses.

Students of mature years, and younger students whose parents or guardians request it, are permitted to choose (among college studies) such special course as they may need. Such students must be prepared to enter upon and pursue with profit the studies chosen. They are required to have the same number of hours of class-work as other students, and to take part in the practicums to which they are assigned. Subject to these requirements, and to the ordinary discipline of the College, any person is at liberty to select from the entire range

of studies such branches as he may wish to pursue, and for such length of time as he may find convenient, the purpose of this arrangement being to bring the advantages of the institution as fully as possible within the reach of every young man and woman in the State. Students are earnestly advised to enter one of the regular courses, and pursue it systematically to the end; but, in cases where that is not feasible, it is intended to make the State College, to the full extent of its resources, a place where any person may obtain that kind and degree of education which is most directly suited to his circumstances and purposes in life.

To those who satisfactorily complete one year or more of such special work, certificates under the seal of the institution are given, setting forth the studies which they have pursued, and their proficiency therein. The provision for partial courses does not extend to the preparatory classes, all studies in them being required.

AGRICULTURAL EXPERIMENT STATION.

The Agricultural department of the College has for several years carried on extensive lines of research and experiment, proper to what is now generally known as an Experiment Station. In accordance with the terms of the recent law of Congress, providing for the establishment of such stations in connection with the colleges founded on the Act of July 2, 1862, the Trustees of the State College have organized the Agricultural department under the title of "The State College Experiment Station," and the work will be increased to the full extent of their available resources. The object of the Station will be to pursue systematic and continuous investigations, but without losing sight of the practical needs of every-day farming. It will endeavor to give assistance to farmers, in solving the problems that perplex and embarras them, and it earnestly desires their coöperation through full and free correspondence, Bulletins of information will be issued from time to time, as they have been for the last four years, and will be sent free of charge, to all applicants in the State.

The working force of the Station, as far as yet appointed, is as follows: H. P. Armsby, Ph. D., Director; William Frear, Ph. D., Vice-Director and Chemist; Wm. A. Buckhout, M. S., Botanist; George C. Butz, M. S., Horticulturist; H. J. Patterson, B. S., Assistant Chemist.

GENERAL STATEMENTS.

1. Degrees.

The degree of Bachelor of Science is conferred upon graduates of all the four years' courses, except the general course in agriculture. The diploma given to graduates of the technical courses contains mention, also, of the special line of technical work pursued.

The degree of Master of Arts, or Master of Science, is conferred upon graduates of the State College, of at least three years' standing, who are known to have been systematically pursuing scientific, literary or professional studies, or who have, satisfactorily to the faculty, studied at least one year in the graduate courses. Higher degrees, such as C. E., Ph. D., D. S., &c., are only conferred at the end of prescribed courses of advanced study, or in recognition of high professional attainments.

2. Graduate Instruction.

Persons who have been graduated in one of the above regular

courses, or an equivalent course elsewhere, are permitted to enter the college for instruction in an advanced course, consisting of such studies as may, in view of the circumstances of each case, be approved by the faculty, receiving at the completion of such course the appropriate degree.

3. Libraries and Reading-rooms.

The library belonging to the College has about four thousand volumes, embracing scientific and technical works, memoirs, scientific essays, agricultural and educational works, &c., in English, French and German, forming the nucleus of an excellent scientific library. From four to five hundred volumes per year are being added.

The reading-room in connection with the College library offers to faculty and students an ample and well-selected list of scientific and other periodicals, foreign and American.

Donations of books and periodicals are invited from friends of the institution, publishers and authors.

Each of the two students' literary societies has a good library of standard and miscellaneous works, and a reading-room supplied with many of the principal literary periodicals and newspapers of the day.

4. Free (Senatorial) Scholarships.

There have recently been established by the trustees fifty scholarships, one for each senatorial district in the State, entitling the holder to *exemption from all College charges* (except for materials used in the laboratories), in any of the regular four-years' College courses. The scholar, male or female, is to be appointed by the Senator of the district, after a competitive examination in the studies required for admission to the freshman class. No person is eligible as a candidate who has previously been admitted to any class in the College.

The holder of the scholarship is admitted to the privileges of any of the regular College courses (*but not the preparatory or special courses*) free of the ordinary charges for incidentals, room-rent and furniture; this immunity to continue for the entire College course, provided that both conduct and class standing be satisfactory to the faculty. A vacancy may be filled after the opening of the College year, if the appointee's attainments do not fall below the standard of the class at the time of the application for admission. For information as to vacancies, time and place of examination, &c., candidates for a scholarship should apply to their Senator, in whose hands the details of appointment have been placed by the College.

5. Discipline.

The discipline of the College is intended to be strict, but reasonable and considerate. It assumes that students come here not to spend their time in idleness, but to prepare themselves for useful and honorable careers in life. The aim of the faculty is to lead students to cultivate habits of steady application, self-control, a high sense of honor, truthfulness, and an interest in maintaining the purity of the moral atmosphere of the institution. Those who are not disposed to support heartily a discipline of this kind are urged not to apply for admission. Students whose influence, after fair trial, is found to be injurious to good scholarship or good morals, will be removed from the institution.

6. **Expenses.**

No charges whatever is made for tuition, except for special instruction in music.

INCIDENTALS.—Each student, whether from a distance or a resident in the neighborhood, is required to pay $17 a year for the fuel, lights, and care of the recitation and other public rooms, viz: $7 for the fall session, $5 for the winter and $5 for the spring. This is the only charge made to pupils who do not room in the College. The charges to those who room in the College are as follows:

FALL SESSION.—Incidentals,		$7
	Room rent, fuel, furniture and light,	12 50
WINTER SESSION.—Incidentals,		5
	Room rent, fuel, light and furniture,	15 50
SPRING SESSION.—Incidentals,		5
	Room rent, fuel, light and furniture,	9

The charge for room rent, fuel and furniture and light is made on the basis of two persons to each room. In cases where a student rooms alone, he will be charged $4 additional per session, besides extra charge for light.

By a resolution of the board of trustees, each student, before he is permitted to enter his name upon the College roll, is required to pay an amount sufficient to cover all his Collegs bills for the current session, besides a special deposit of $5 as security against damages; or, in case he cannot pay immediately, to give a note, with sufficient security, for the payment at some future time, unless excused by the executive committee.

LABORATORY EXPENSES.—Students in the laboratories pay a small charge for their outfit; also, for apparatus destroyed and material consumed by them.

BOARDING.—The college does not maintain a boarding hall, and most students depend upon the boarding houses in the vicinity, the regular charge being three dollars per week. The college offers special facilities to those who board themselves singly and also to the College Boarding Club, which supplies its members, now numbering more than forty, with good boarding at about two dollars and a quarter per week.

FURNITURE.—The furniture provided for students who room in the building consists of a bedstead, mattress, table, washstand and chair. The student provides all other articles, including bedding, wash-bowl and pitcher, mirror, lamp, etc.

UNIFORM.—Each cadet is required to provide himself with a uniform of dark blue cloth—coat, pantaloons and cap—as per pattern in the college. The cap and pantaloons are such as may be worn upon any occasion without attracting undue attention. One dress coat, with proper care, will last during an entire college course. Measures are taken at the college, and orders filled by Wanamaker and Brown, Philadelphia. The uniform must be paid for when ordered.

MUSIC.—Instruction on the piano or organ is given at the rate of ten dollars for twenty lessons, and three dollars per quarter for use of instrument in practicing.

WASHING is at the rate of fifty cents per dozen.

BOOKS AND STATIONERY can be procured at stores in the village at Philadelphia retail prices.

DAMAGES.—Persons causing special damages will be required to pay

for the same. General damages will be assessed upon the body of students.

All remittances should be made to the President, State College, Centre county, Pa., by draft, or by money order drawn on State College post-office.

SESSIONS AND VACATIONS.

The college year is divided into three sessions:

The Fall Session of about fourteen weeks, beginning on the second Wednesday of September and ending on the third Friday of December; the Winter Session of twelve weeks, and the Spring Session of twelve weeks.

VACATIONS.—The winter vacation is three weeks, the spring, one, and the summer, ten.

ADMISSION TO COLLEGE.

Examinations for admission are held on Tuesday of Commencement week and on the day before the opening of the fall session, the dates being, for 1888, the 26th of June and the 11th of September, respectively. It is desirable, on every account, that candidates be present on one or both of these days. Those who cannot do so will be examined at any time during the year and admitted to the class for which they are found prepared.

In all cases the applicant for admission must present evidences of good character, and, when coming from another college, of honorable dismissal.

For admission to the Freshman class candidates (of either sex) must be at least fifteen years of age, and pass a satisfactory examination in the following subjects:

1. FOR THE COURSES IN GENERAL SCIENCE AND CIVIL AND MECHANICAL ENGINEERING: English Grammar; Arithmetic; Geography, both Descriptive and Physical; United States History; Higher Algebra, through Quadratics and Progressions; Wentworth's Geometry, four books; and the elements of Natural Philosophy, as much as is contained in Avery, Rolfe and Gillet, or Gage.

2. FOR THE LATIN-SCIENTIFIC COURSE: the same as above, with the addition of four books of Cæsar and four orations of Cicero.

3. FOR THE GENERAL COURSE IN AGRICULTURE: Robinson's Complete Arithmetic (or its equivalent) to ratio; English Grammar (Syntax and Etymology); Geography and Spelling.

4. FOR THE SPECIAL COURSE IN AGRICULTURE: the same as for the General Scientific Course.

5. FOR THE SPECIAL COURSE IN CHEMISTRY: applicants will be admitted without examination, except in Mathematics.

In that branch, at present, the applicant must be fully prepared to pass examination in arithmetic, including the Metric system, and the first two hundred pages of Newcomb's Elementary Algebra; but, in order to derive the greatest advantage from the course, it is recommended that students be so far advanced as to have completed the Mathematical Studies of the Freshman year.

6. FOR THE COURSE IN MECHANIC ARTS: the same as for admission to the General Course in Agriculture.

7. FOR THE LADIES' COURSE IN LITERATURE: the same as for the General Science Course.

8. FOR PARTIAL COURSES, applicants must at least be prepared to en-

ter the Freshman class in the branches of study which they wish to pursue.

9. GRADUATES OF STATE NORMAL SCHOOLS and of a SELECT LIST OF HIGH SCHOOLS AND ACADEMIES in Pennsylvania, whose standard of requirements has been ascertained to be satisfactory, will be admitted to the Freshman class without further examination in studies which, as shown by their diploma or certificate, they have successfully completed in such institution. Such certificates must show specifically the amount of work done.

10. THE HOLDERS OF SENATORIAL SCHOLARSHIPS are admitted on the certificate of the Examining Committees in the several Senatorial districts.

11. APPLICANTS FOR ADVANCED STANDING, in any course, must pass a further examination in the studies which have been pursued by the class for which they are candidates.

THE FULL COURSES OF INSTRUCTION occupy four years, with three terms, or sessions, in each year. The following schedules of studies indicate the amount of work required in several of the courses or the equivalent which will be accepted from candidates for advanced standing.

1. GENERAL COURSE IN AGRICULTURE.

First Year.

FALL SESSION.—Arithmetic (4), Physiology (4), United States History (3), English Grammar (5).

WINTER SESSION.—Algebra (5), U. S. History (5). English Composition (5).
Practicum.—Zoology, Laboratory Work.

SPRING SESSION.—Algebra (5), Botany (5), English Composition (5).
Practicum—Book-keeping.

Second Year.

FALL SESSION.—Algebra (4), Geometry (2), Natural Philosophy (4), Elements of Agricultural Chemistry (5).
Practicums—Drawing (4), Horticulture (4).

WINTER SESSION.—Algebra (4), Geometry (2), Natural Philosphy (4), Elements of Scientific Agriculture (5).
Practicum—Mechanic Arts (6).

SPRING SESSION.—Algebra (2), Geometry (4). Descriptive Botany (4), Elements of Scientific Agriculture (5).
Practicums—Botany (4), Horticulture (4).

Third Year.

FALL SESSION.—Chemistry (4), Horticulture (3), Geometry (3), Mechanics (4).
Practicums—Chemistry (4), Zoology (4), Mechanics (4).

WINTER SESSION.—Chemistry (4), Geometry (3), Trigonometry (3), Zoology (4).
Practicums—Chemistry (8), Zoölogy (4).

SPRING SESSION.—Agricultural Engineering (3), Comparative Physiology (3), Trigonometry and Surveying (5), Mental Science (4).
Practicums—Chemistry, one half term, Quantitative Analysis (10), Surveying, one half term (8).

Fourth Year.

FALL SESSION.—Agricultural Chemistry (3), Anatomy and Breeding (4), Botany (4), Political Economy (4).
Practicums—Dissection (2), Chemistry (Quantitative Analysis) (4), Botany (4).

WINTER SESSION.—Agricultural Chemistry (4), Feeding (4), Veterinary Science (3), Constitutional Law (4).
Practicums—Care of Stock (4), Analysis of Agricultural Products (6).

SPRING SESSION.—Fertilizers (4), Entomology (4), Dairy Farming (3), Moral Science (4).
Practicums—Agriculture (6). Entomology (6).

2. ADVANCED COURSE IN AGRICULTURE.

[The studies of the first two years in this Course are the same as in the General Science or the Latin-Scientific Course.]

Junior Class.

FALL SESSION.—Rational Mechanics (4), Agricultural Chemistry (3), Cryptogamic Botany (4), Logic (3).
Practicums—Physics (4), Chemistry (6).

WINTER SESSION.—Physics (4), Agricultural Chemistry (4), Zoology (4), Agricultural Engineering (3).
Practicums—Zoology or Physics (4), Chemistry (6).

SPRING SESSION.—Mineralogy (1), Mental Science (4), Entomology (2), Fertilizers (4), Crops (1), Zoology (2).
Practicums—Agriculture (4), Entomology (6).

Senior Class.

FALL SESSION.—Anatomy and Breeding (4), Geology (4), Political Economy (4), Horticulture (3), Crops (2).
Practicums—Agriculture (5), Dissection (5).

WINTER SESSION.—Geology (2), Constitutional Law (4), Feeding (4), Veterinary (4), Farm Economy (1).
Practicum—Agriculture (10).

SPRING SESSION.—Dairy (3), Sheep Husbandry (1), Moral Science (4), History of English Literature (3), History of Agriculture (1).
Practicum—Agriculture, (original work) Thesis.

3. SPECIAL COURSE IN AGRICULTURE.

[See explanation on previous page.]

First Year.

FALL SESSION.—Chemistry (4), Algebra (3), Geometry (3), Natural Philosophy (4).
Practicums—Horticulture (4), Chemistry (4), Drawing (4).

WINTER SESSION.—Chemistry (4), Agricultural Engineering (3), Trigonometry (3), Geometry (3).
Practicums—Chemistry (8), Mechanic Arts (6).

SPRING SESSION.—Chemistry (3), Physiology (3), Botany (4), Trigonometry (5).
Practicums—Chemistry (4), Horticulture (2), Botany (4), Physiology (2).

Second Year.

FALL SESSION.—Agricultural Chemistry (3), Anatomy and Breeding (4), Botany (4).
Practicums—Chemistry (6), Dissection (5).

WINTER SESSION.—Agricultural Chemistry (4), Cattle Feeding (4), Zoology (4).
Practicums—Chemistry (6), Zoology (4), Agriculture (6).

SPRING SESSION.—Fertilizers (4), Entomology (4), Dairy Farming (4), Sheep Husbandry (1), Zoology (2).
Practicums—Entomology (6), Agriculture (6), Surveying (3).

4. GENERAL SCIENCE COURSE.

Freshman Class.

FALL SESSION.—Algebra (3), Geometry (3), German (5), History (4).
Practicums—Drawing (4), Horticulture (4).

WINTER SESSION.—Trigonometry (3), Geometry (3), Rhetoric (4), German (5).
Practicmms—Drawing (2), Mechanic Arts (6).

SPRING SESSION.—Trigonometry and Surveying (5), Physiology (3), German (5), Tactics (2).
Practicums—First half of session—Horticulture (4). Second half of session—Physiology (4); Drawing, all the session (6).

Sophomore Class.

FALL SESSION.—Analytical Geometry (4), Chemistry (4), German (2), French (3), History (2), Surveying (1).
Practicums—Surveying (4), Chemistry (4).

WINTER SESSION.—Analytical Geometry (4), Chemistry (4), German (2), French (3), History (2).
Practicums—Chemistry (8), Mechanic Arts (2).

SPRING SESSION.—Chemistry (3), Descriptive Botany* or Railroad Surveying (4), History (2), French (3), Differential Calculus* (4).
Practicums—Chemistry (6), Botany (4).

Junior Class.

FALL SESSION.—Rational Mechanics (4), French (2), German (2), Logic (3), Botany (4), or Integral Calculus (3).
Practicums—Mechanics (4), Botany (4), Anatomy and Physiology (4).
WINTER SESSION.—Physics (4), French (3), Zoology (4), Constitutional History (4).
Practicums—Physics (4), Zoology (4), Botany (2).
SPRING SESSION.—Physics (4), Mineralogy (1), Mental Science (4), English Literature (4), Zoology (2).
Practicums—Physics (3), Mineralogy (6).

Senior Class.

FALL SESSION.—Physics (4), Geology (4), Political Economy (4), English Literature (3).
Practicums—Physics (2), Geology (5).
WINTER SESSION.—Geology (2), Constitutional Law (4), Astronomy (3), History of Civilization (4), Physics (3).
Practicums—Geology (3), Physics (2).
SPRING SESSION.—International Law (4), Astronomy (3), Moral Science (4), History of English Literature (3).
Practicums—Original work—elective (5), Thesis or Oration.

5. LATIN-SCIENTIFIC COURSE.

Freshman Class.

FALL SESSION.—Algebra (3), Geometry (3), German (5), Latin (4).
Practicums—Drawing (4), Horticulture (4).
WINTER SESSION.—Trigonometry (3), Geometry (3), Latin (4), German (5).
Practicums—Drawing (2), Mechanic Arts (6).
SPRING SESSION.—Trigonometry and Surveying (5), German (5), Latin (4).
Practicums—First half of session—Physiology (4). Second half of session—Horticulture (4); Drawing, all the session (6).

Sophomore Class.

FALL SESSION.—Analytical Geometry (4), Chemistry (4), History (2), Latin (3), French (3), Surveying (1).
Practicums—Surveying (4), Chemistry (4).
WINTER SESSION.—Analytical Geometry (4), Chemistry (4), History (2), Latin (3), French (3).
Practicums—Chemistry (6), Mechanic Arts (2).
SPRING SESSION.—Chemistry (3), Descriptive Botany* or Railroad Surveying (4), Differential Calculus* (4), Physiology (3), French (3).
Practicums—Chemistry (6), Botany (4).

[The studies of the last two years in this Course are the same as in the General Science Course.]

6. COURSE IN CHEMISTRY AND PHYSICS.

[The studies of the first two years in this Course are the same as in the General Science or the Latin-Scientific Course.]

Junior Class.

FALL SESSION.—Rational Mechanics (4), Chemistry (3), Logic (3), Integral Calculus (3).
Practicums—Mechanics (4), Chemistry (8).
WINTER SESSION.—Physics (4), Chemistry (4), Method of Least Squares (2).
Practicums—Physics (4), Chemistry (16).
SPRING SESSION.—Physics (5), Chemistry (4), Mineralogy (1), Mental Science (4).
Practicums—Physics (3), Chemistry (3), Mineralogy (6).

Senior Class.

FALL SESSION.—Physics (4), Chemistry (3), Geology (4), Political Economy (4).
Practicums—Physics (4), Chemistry (8).
WINTER SESSION.—Physics (3), Chemistry (3), Geology (2), Constitutional Law (4).
Practicums—Physics (4), Chemistry (14).
SPRING SESSION.—Physics (4), Chemistry (3), Moral Science (4), History of English Literature (3).
Practicums—Physics (3), Chemistry (10), Thesis.

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*NOTE.—For the Differential Calculus of this session, students preparing for the Course in Agriculture or Natural History may substitute seven hours of practicum in Chemistry. Students preparing for the Course in Civil Engineering will substitute Railroad Surveying for Descriptive Botany.

7. COURSE IN CIVIL ENGINEERING.

[The studies of the first two years in this Course are the same as in the General Science or the Latin-Scientific Course.]

Junior Year.

FALL SESSION.—Rational Mechanics (4), Integral Calculus (3), Descriptive Geometry (4), Mechanical Drawing (2).
Practicums—Surveying (6), Experimental Mechanics (4).

WINTER SESSION.—Applied Mathematics (3), Method of Least Squares (2), Physics (4), Descriptive Geometry (3).
Practicums—Mechanical Drawing (8), Physics (4).

SPRING SESSION.—Analytical Mechanics (2), Properties of Materials (3), Railroad Surveying and Earth-work (3), Physics (4), Mineralogy (1).
Practicums—Topographical Surveying (6), Mineralogy (6).

Senior Year.

FALL SESSION.—Graphical Statics (4), Political Economy (4), Analytical Mechanics (3), Geology (4).
Practicums—Geology (4), Field-work (4).

WINTER SESSION.—Constitutional Law (4), Geodesy and Practical Astronomy (6), Graphical Statics (4), Sanitary Engineering (4).
Practicum—Draughting (12).

SPRING SESSION.—Specifications and Contracts (2), Map Projections (3), Moral Science (4).
Practicums—Field Practice (4), Draughting (2), Thesis.

8. COURSE IN MECHANICAL ENGINEERING.

Freshman Class.

FALL SESSION.—Algebra (3), Geometry (3), German (5), History (4).
Practicums—Drawing (4), Mechanic Arts (4).

WINTER SESSION.—Trigonometry (3), Geometry (3), Rhetoric (4), German (5).
Practicums—Drawing (2), Mechanic Arts (6).

SPRING SESSION.—Trigonometry and Surveying (5), Physiology (3), German (5).
Practicums—First half session—Mechanic Arts (4), Physiology (4). Second half of Session—Surveying (8).

Sophomore Class.

FALL SESSION.—Analytical Geometry, (4), Chemistry (4), German (2), French (3), History (2).
Practicums—Drawing (6), Chemistry (4).

WINTER SESSION.—Analytical Geometry (4), Chemistry (4), German (2), French (3), History (2).
Practicums—Chemistry (8), Mechanic Arts (2).

SPRING SESSION.—Chemistry (3), Mechanism (4), History (2), French (3), Differential Calculus (4).
Practicums—Drawing (6), Mechanic Arts (4).

Junior Class.

FALL SESSION.—Rational Mechanics (4), Integral Calculus (3), Descriptive Geometry (4), Graphical Statics (4).
Practicums—Mechanical Drawing (4), Mechanics or Shop-work (4).

WINTER SESSION.—Analytical Mechanics (3), Method of Least Squares (2), Physics (4), Descriptive Geometry (3), Integral Calculus (2).
Practicums—Mechanical Drawing (5), Shop-work (5).

SPRING SESSION.—Analytical Mechanics (3), Properties of Materials (3), Differential Equations (3), Physics (4).
Practicums—Mechanical Drawing (4), Shop-work (4), Mineralogy (4).

Senior Class.

FALL SESSION.—Quaternions (4), Political Economy (4), Valve Gearing and Experimental work with Indicator and Inspirator (3), Geology (4).
Practicums—Mechanical Drawing (6), Shop-work (6).

WINTER SESSION.—Quaternions (3), Mechanics of Engineering (4), Constitutional Law (4), Astronomy (4).
Practicums—Mechanical Drawing (6), Shop-work (6).

SPRING SESSION.—Astronomy (4), Machine Designing (4), Imaginaries (3), Steam Engine (3).
Practicum—Drawing. *Thesis.*

9. SPECIAL COURSE IN CHEMISTRY.

First Year.

FALL SESSION.—General Chemistry (4), Mathematics (5), German (5).
Practicum—Laboratory Practice.
WINTER SESSION.—Chemistry (4), Mathematics (5), German (5).
Practicum—Qualitative Analysis.
SPRING SESSION.—Chemistry (3), Mathematics (5), German (5).
Practicum—Qualitative Analysis.

Second Year.

FALL SESSION.—German (2), Mathematics (4), Chemistry, with Quantitative Analysis.
WINTER SESSION.—German (2), Mathematics (4), Chemistry, with Quantitative Analysis.
SPRING SESSION.—Mathematics (4), Chemistry, with Quantitative Analysis.

THE PREPARATORY DEPARTMENT.

This department is intended to furnish instruction to students well trained in the Elementary Common School Branches, and yet not fully prepared for admission to the Freshman class. It does not, however, offer instruction in the Primary branches, nor is it in any sense a High School. The studies are arranged chiefly with reference to their importance in preparing students for one of the regular four years' College Courses.

Special care is taken to make the instruction systematic and thorough, that the foundation for future study may be securely laid.

Students in this department, except those who are under the immediate care of their parents or guardians, are required to room in that part of the building assigned to the department. Here they are under the personal supervision of the principal of the department and his assistants.

In addition to the regulations governing the College students, they are required to observe study hours. During such periods they must neither pay nor receive visits; and every effort is made to train them to habits of close attention and to correct methods of study. At other times than in recitation and study hours, they have ample opportunity for healthful sports and recreation.

ADMISSION.

FIRST YEAR.—All applicants for admission must be at least fourteen years of age, and be prepared, at the beginning of the autumn session, to pass a satisfactory examination in the following branches:

Arithmetic—Thompson's Complete, (or its equivalent) to Ratio; English Grammar, Brown's Revised, (or its equivalent,) to page 250, which includes Etymology and Syntax.

In Geography, Spelling, Reading and Penmanship, the examination must show such acquaintance with those branches as not to require further instruction in them.

SECOND YEAR.—Those who apply for admission to the autumn session of the *Second Year* must be prepared to pass, in addition to the above, an examination on all the work of the *First Year*.

All persons entering classes after the opening of the first session will be required to pass an examination in the work already gone over by the class into which they seek admittance.

TUITION in this department is free; other charges are the same as in the College proper.

EXAMINATION FOR ADMISSION, Tuesday, September 11, 1888, at nine o'clock, A. M.

SCHEME OF WORK.

In connection with the schedule, the following outline of work will indicate the course of studies more in detail:

FIRST YEAR.

Fall—Thompson's complete Arithmetic, completed from Ratio.
Hutchison's Physiology and Hygiene, completed.
Murray's Essentials of English Grammar.
Scudder's History of the United States, to part II.
Comstock's First Latin Book, fifty lessons, (optional).

Winter—Newcomb's Elementary Algebra, to page 80.
Murray's Advanced Lessons in English Composition to part III.
Scudder's History of the United States, completed.
Zoology, Morse's First Lessons.
Comstock's Lessons in Latin, completed, (optional).

Spring—Elementary Algebra, continued to page 152.
Crittenden's English Composition, completed.
Murray's Advanced Lessons in Analysis, completed.
Packard's Manual of Book-keeping.
Cæsar, Books I and II, (optional).

SECOND YEAR.

Fall—Elementary Algebra, continued to page 244.
Wentworth's Plane Geometry, Book I.
Avery's First Principles of Natural Philosophy, to chapter VII.
Lancaster's History of England, completed.
Cæsar, Books III and IV; Allen's Composition, first 13 Lessons, (optional).

Winter—Newcomb's College Algebra, from page 85 to 200.
Geometry, continued through Book II.
Natural Philosophy, completed.
Houston's Physical Geography, completed.
Cicero—First two orations *in Catilinam*; Composition, continued to 24th Lesson, (optional).

Spring—Algebra, continued to page 320.
Plane Geometry completed.
Botany, Gray's First Lessons.
Civil Government, Young's Class Book.
Cicero—Third and Fourth Orations *in Catilinam*; Composition, continued to 34th Lesson, (optional).

SCHEDULE OF PREPARATORY STUDIES.

Year.	Session.	Scientific Course.	Hours per week.	Latin-Scientific.	Hours per week.
"B," or First Year.	Fall.	United States History, . .	3	United States History, . .	4
		Arithmetic, ...	4	Arithmetic, ...	4
		Physiology, ...	4	Physiology, ...	4
		English Grammar, ...	5	Latin, ...	5
	Winter.	Algebra, ...	5	Algebra, ...	5
		English Composition, . .	5	English Composition, . .	5
		United States History, .	5	Latin, ...	5
		Zoology, ...	5	Zoology, ...	5
	Spring.	Algebra, ...	5	Algebra, ...	5
		English Analysis, ...	5	English Composition, . .	5
		English Composition, . .	5	Latin, ...	5
		Drawing, ...	3	Drawing, ...	3
		Book-keeping, ...	4	Book-keeping, ...	4
"A," or Second Year.	Fall.	Geometry, ...	2	Geometry, ...	2
		Algebra, ...	4	Algebra, ...	4
		Physics, ...	4	Physics, ...	4
		English History, ...	5	Latin, ...	5
		Drawing, ...	5	Drawing, ...	5
	Winter.	Algebra, ...	4	Algebra, ...	4
		Geometry, ...	2	Geometry, ...	2
		Physics, ...	4	Physics, ...	4
		Physical Geography, . .	5	Latin, ...	5
		Drawing, ...	5	Drawing, ...	5
	Spring.	Algebra, ...	5	Algebra, ...	5
		Geometry, ...	4	Geometry, ...	4
		Civil Government, . . .	2	Civil Government, . . .	2
		Botany, ...	4	Latin, ...	5
		Drawing, ...	5	Drawing, ...	5

The following list shows at a glance the leading departments of study.

1. AGRICULTURE (Three Courses) and AGRICULTURAL CHEMISTRY; with constant illustrations on the Farm and in the Laboratory.
2. BOTANY and HORTICULTURE; theoretical and practical. Students taught original study with the microscope.
3. CHEMISTRY; with an unusually full and thorough course in the Laboratory.
4. CIVIL AND MECHANICAL ENGINEERING; very extensive field and shop practice with best modern instruments.
5. HISTORY; Ancient and Modern, with original investigation.
6. LADIES' COURSE in LITERATURE and SCIENCE; two years. Ample facilities for Music, vocal and instrumental.
7. LANGUAGE and LITERATURE; Latin, (optional,) French, German and English, (required,) one or more continued through the entire course.
8. MATHEMATICS and ASTRONOMY; pure and applied.
9. MECHANIC ARTS; combining shop-work with study—three years' course; new building and equipment.
10. MENTAL, MORAL and POLITICAL SCIENCE; Constitutional Law and History, Political Economy, &c.
11. MILITARY SCIENCE; instruction theoretical and practical, including each arm of the service.
12. PHYSICS; Mechanics, Sound, Light, Heat, Electricity, &c., a very full course, with *extensive Laboratory* practice.
13. PREPARATORY DEPARTMENT; Two years—carefully graded and thorough.

Fall term opens September 14, 1887; Winter term, January 11, 1888; Spring term, April 5, 1888.

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